60mm mortars

Part 1

By Clyde Barrow

The following is part one of a series on building a 60mm mortar patterned after the type used by the U.S.in WWII. This same design with minor alterations, is still in production and standard issue in most NATO countries. The complete setup weighs about 40 pounds and breaks down into three sections; baseplate,bipod and barrel. This allows for quick setup/takedown and easy transport. The mortar bombs, either high explosive or smoke type, weigh just under 3 lbs. each. The 60mm mortar is the cheapest and simplest method available for a two or three man squad to inflict artillery level damage to fixed targets at ranges of 300 yards to ¼ mile or more. Although the design specs presented can be altered for use in producing an 81mm mortar, the increased weight required limits the larger unit to use as a vehicle mounted weapon.For reasons of mobility, we will concentrate on the 60mm unit.

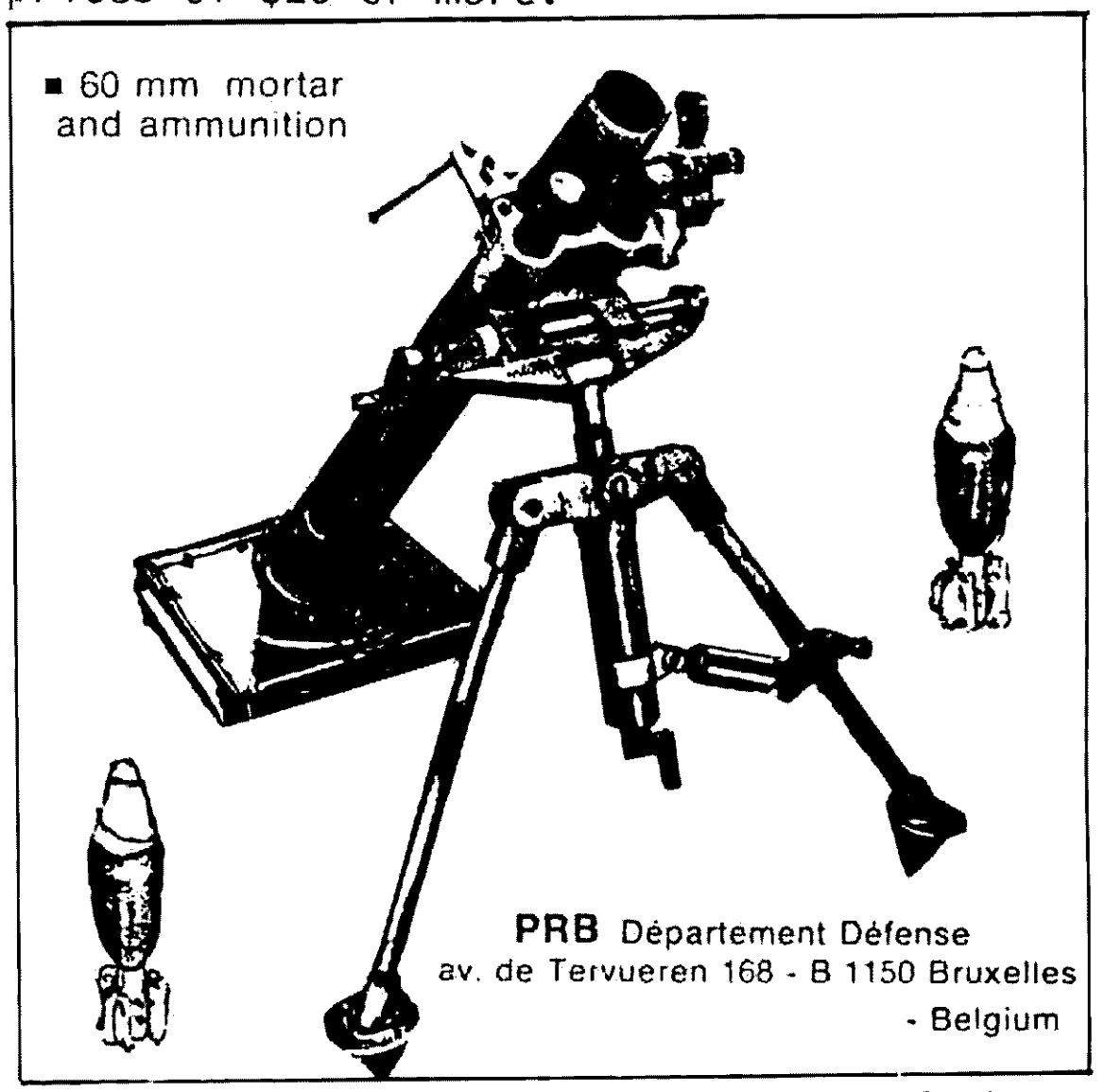


Once Fired 60MM Inert Mortar Rounds

Practice Bombs

60mm practice rounds are available from S and R Company, RD 2 Box 71, Arkport, NY 14807. Price is$6.00 each plus shipping charges (3 lbs.each). Practice rounds were identical to live ammo except that they carried a small smoke charge instead of an explosive. They were used for target practice only.

The examples from S and R have been "demilled" by unscrewing the nosepiece and drilling a 7/16" diameter hole through the fuse assembly. The nose pieces are included although impact has smashed the plunger into a permanently "fired" position. These rounds look as if they have been in storage on the ocean floor since WWII. They are heavily caked in rust, although they don't look too bad after a good bath in naval jelly (rust remover). The fuse bodies and brass primer units are firmly corroded in place. These rounds are not as hopeless as they sound. The bodies and tail sections are in good shape and one would be hard pressed to copy them for the price of $6. The fuse and base assemblies could be either drilled and threaded to accept repair sections or drilled and chiseled out entirely, to be replaced with new units.Even if you intend to produce all of your own rounds from scratch, I suggest you obtain a couple of these practice bombs for reference. I doubt if they will be available for long, and they are the only examples I've seen for sale at less than collector's prices of $20 or more.



The 60mm mortar round consists of three main sections. 1) An aluminum plunger housing w/ plunger and firing pin that screws into the main fuse body, also of aluminum. 2) A forged steel body threaded at the front to accept the plunger/fuse assembly and at the rear for attachment of the tail assembly. 3) A tail assembly consisting of a machined tube, closed and threaded at the front to fit the body, and threaded at the rear for the brass primer unit. The tube is hollow and carries the launching charge. The bomb is stabilized in flight by four sets of stamped steel fins that are spot welded to the outside of the tube. A stamped steel ring with spring clips is fitted around the front of the tail. These clips are intended to hold secondary sheets or bags of propellant for increasing the range of the round.

The following dimensions will allow you to copy all components of the 60mm bomb design.

GENERAL. The 60-mm mortar fires complete, semifixed rounds of ammunition. The rounds are "complete" since each round comes packed in an individual container, complete with its fuze and propellent charge. The rounds are "semifixed" since part of the propellent charge may be removed to vary the range.

All rounds are provided with stabilizing fins which make the round stable in flight and cause it to strike fuze end first, even though it is fired from a smoothbore weapon.

Each round (except the training projectile) has a propelling charge consisting of an ignition cartridge in the base of the fin assembly and four propellent increments (bundles of sheet powder) which are fitted between the blades of the fin. Each increment is called a *charge*. To prepare a round for firing with a certain charge, those increments not needed are removed from the shell.

Ammunition allowances for training are found in T/A 23-100.

DESCRIPTION AND CHARACTERISTICS. Description and characteristics of the principal classes of 60-mm mortar ammunition are:

High Explosive (HE), M49A2 (fig. 8).
Weight—3.00 pounds.
Color—Olive drab with yellow markings.
Filler—TNT bursting charge.
Fuze—M52 super-quick fuze.
Range—2,000 yards.
Used for fragmentation and casualty effect against personnel.

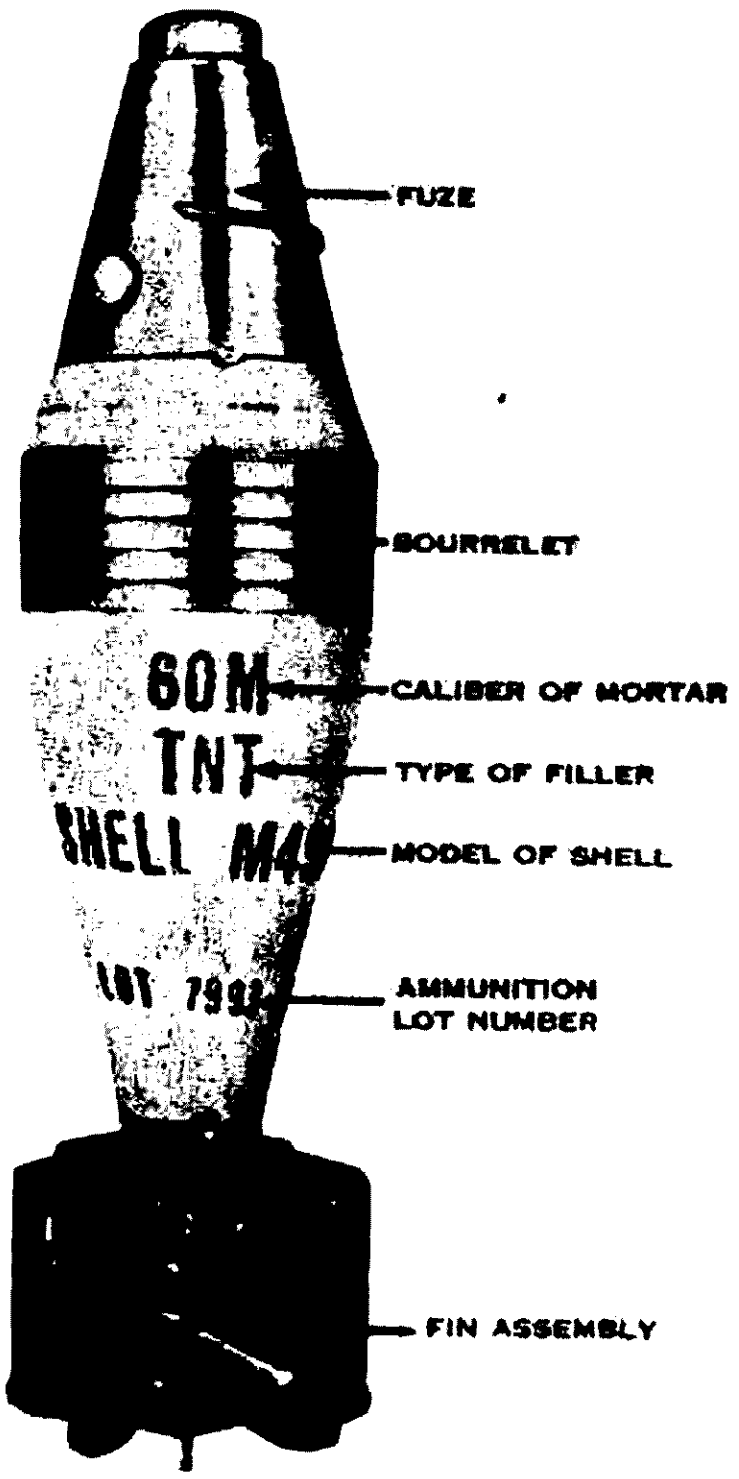
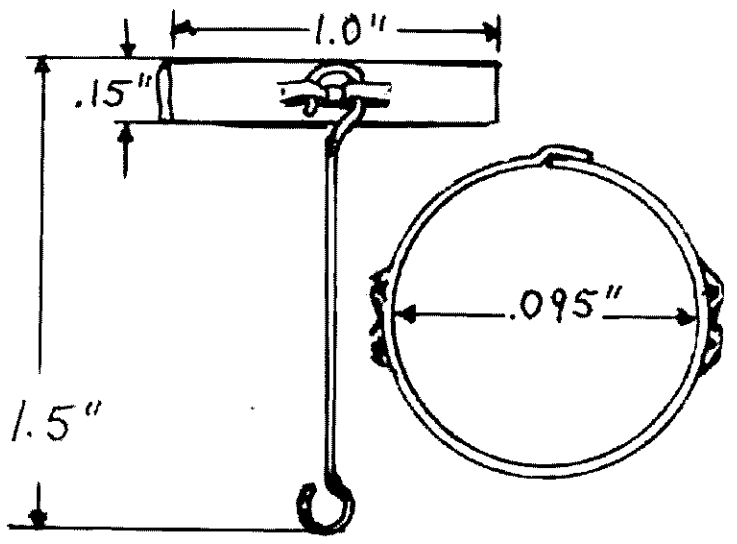
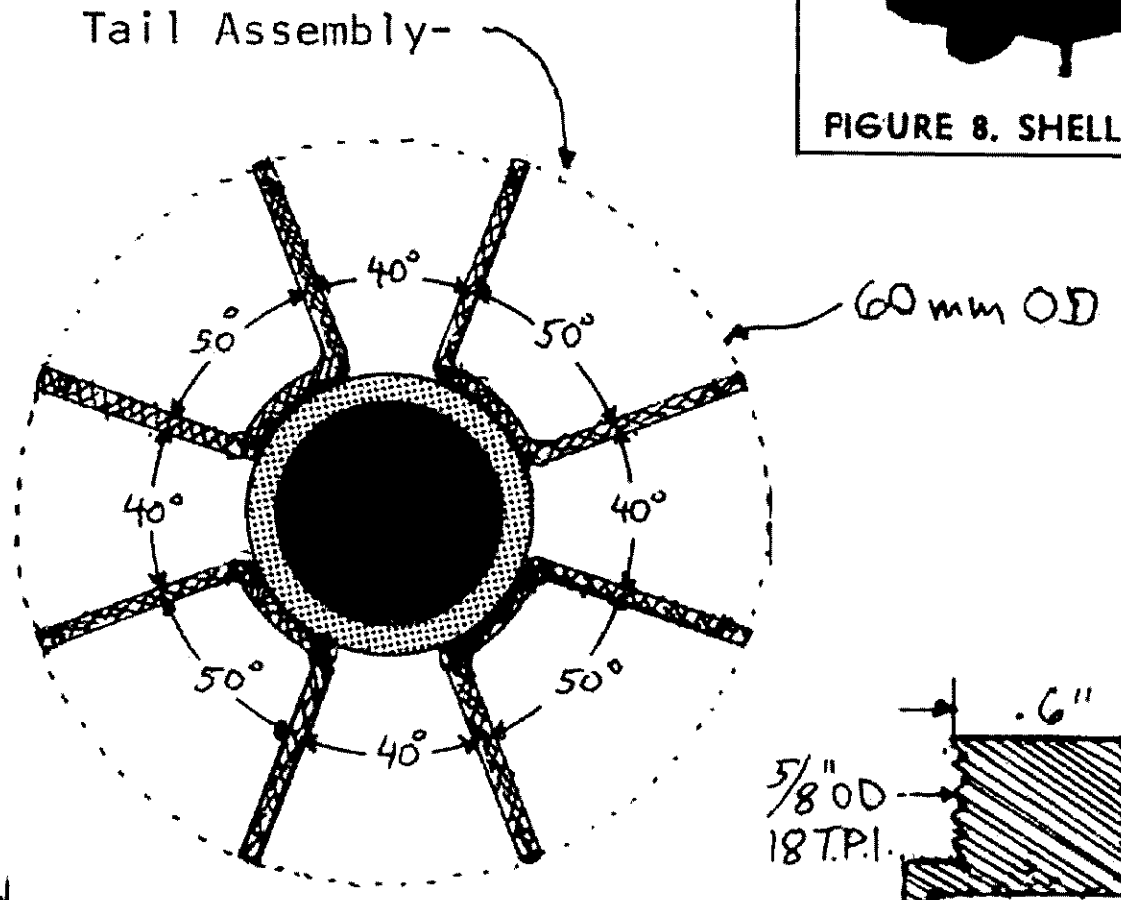
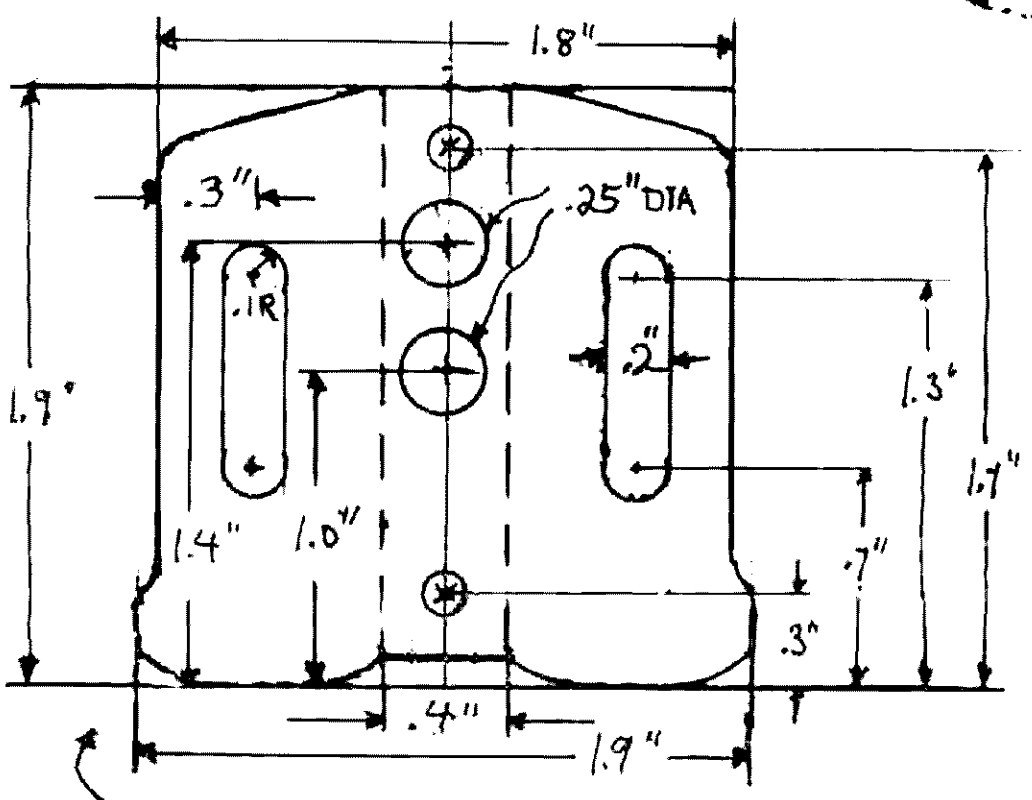


FIGURE 8. SHELL, HIGH EXPLOSIVE M49A2



Clip/Collar Assembly





Fin Pattern (make 4)

M52 FUZE. General. This standard fuze, (fig. 12), a super-quick type, is identified by PDF (point detonating fuze) M52 stamped on the body. This fuze is designed to function before any penetration occurs, permitting the maximum surface effect of fragmentation of the shell. For use in the field, it is issued assembled to the shell as a part of the complete round. To prepare for firing it is only necessary to remove the safety wire.

Safety features. This fuze is classified as bore-safe. It is equipped with safety devices that keep the bursting charge from exploding while the shell is in the barrel—even should the primer or detonator malfunction.

A safety wire passes through the body of the fuze and the set-back pin, thereby locking all movable parts in their original safe position. Pull the safety wire just before firing (fig. 12). If a round is fired without pulling the safety wire, it may or may not explode upon impact. The safety wire is designed to lock the set-back pin in place only during normal handling of the round before firing.

The set-back pin, held in place by the safety wire, in turn locks the safety pin in position. The set-back pin is supported by a spring and is positioned in a recess of the safety pin. Until the set-back pin moves out of this recess the safety pin is locked in the body of the fuze.

The safety pin, held in place by the set-back pin, is the main locking device of the fuze. It holds the slider (which contains the primer and detonator) in its retracted position and prevents premature alinement of the various elements of the powder train.

Functioning. The fuze is not armed until the primer and slider detonator are alined with the firing pin and booster lead. The first step in the arming of the fuze is the removal of the safety wire just before firing. The shell, when inserted in the barrel, slides down until the primer of the ignition cartridge strikes the firing pin of the mortar. The combined forces of the shell striking the breech of the mortar and the blow delivered to the shell by the propelling charge gases cause the inertia of the set-back pin to overcome the resistance of the set-back pin spring. This permits the set-back pin to move toward the base of the fuze (fig. 12). This movement withdraws the shank of the setback pin from the recess of the safety pin. The safety pin, now being released by the set-back pin, is thrown outward by the action of the safety pin spring, but is prevented from leaving the fuze by striking and bearing against the bore of the mortar. At this time, the safety pin has not moved far enough to disengage the slider, and the slider remains locked in its unarmed position.

When the shell leaves the muzzle and the safety pin no longer rides against the bore, the pin and spring fly out of the fuze, thereby releasing the slider. Under the action of the slider spring, the slider is forced to the opposite end of its chamber. The slider locking pin, pressed upward by its spring and guided by a groove in the lower surface of the slider, is lined up with a recess in the slider. The spring forces it into the recess, locking the slider in position and completing the alinement of the powder train. At this time, the fuze is completely armed.

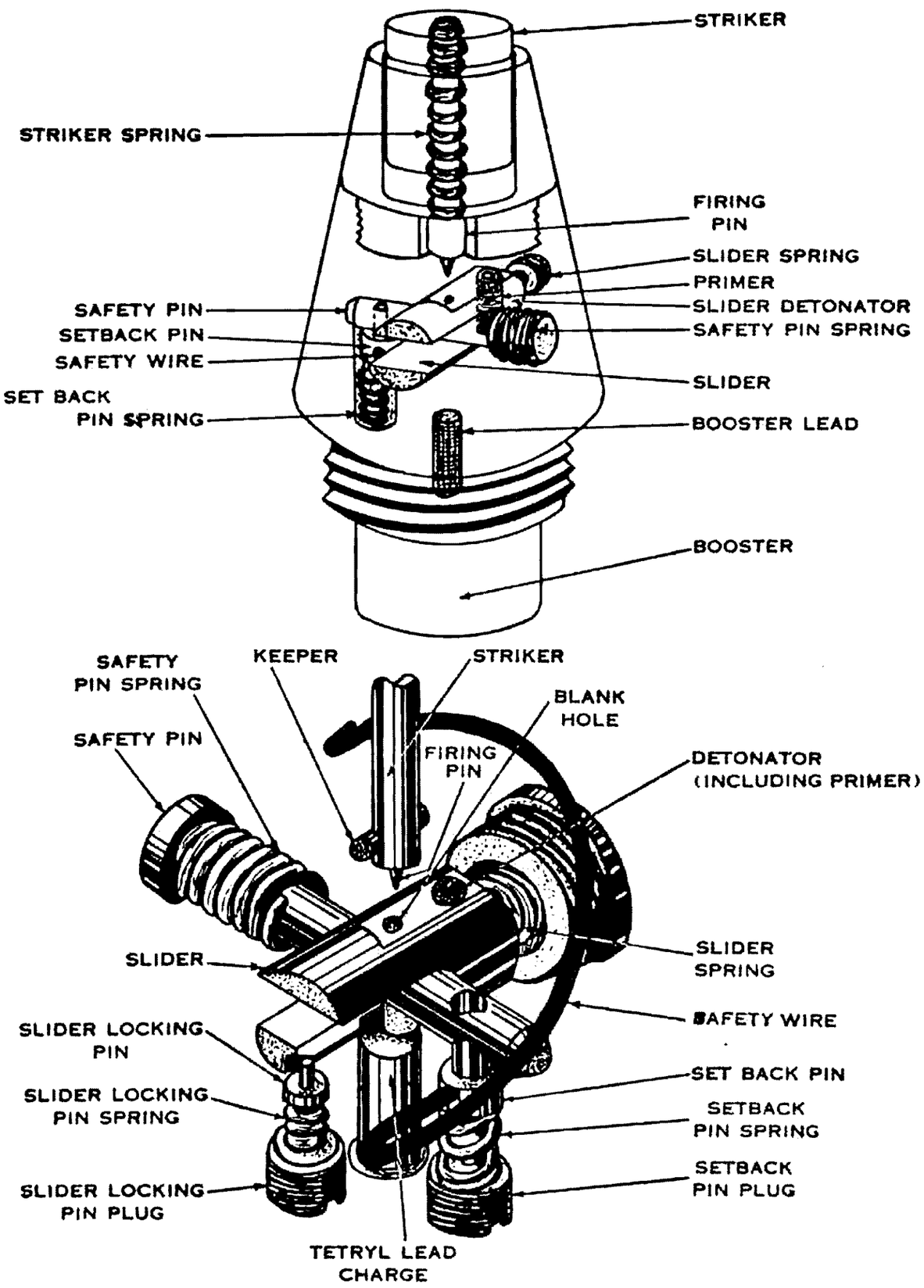
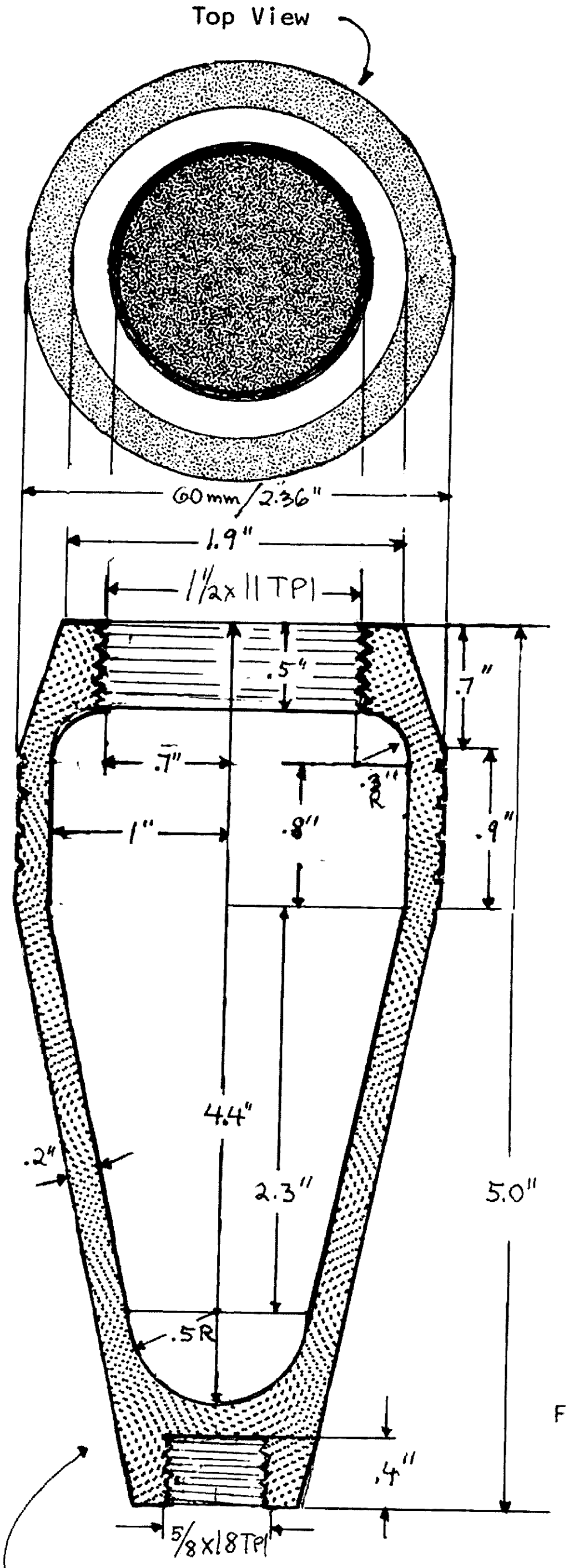
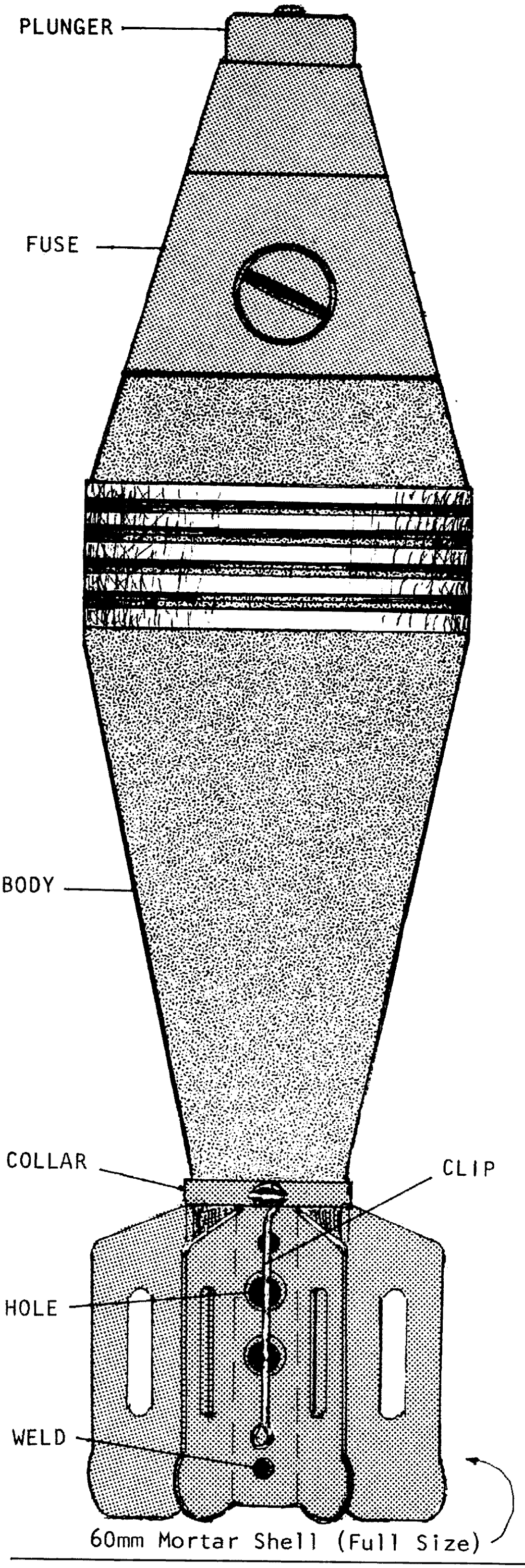


FIGURE 12. WORKING PARTS OF M52 FUZE

When the shell hits the ground, the striker is compressed and drives the firing pin into the primer of the slider detonator. The flash from the primer ignites the detonator, which in turn explodes the booster lead and the booster. The explosion of the booster detonates the TNT filler in the body of the shell.



60mm Mortar Shell Body Forged Steel



60mm Mortar Shell (Full Size)

Continued Next Issue

60mm Mortar

part 2 BY CLYDE BARROW

NOTE: Please make the following corrections on pp.23 and 25 of Vol.2/Issue 1.

PP. 23- Clip collar assembly ID is .95" (not .095").

- The third row of vent holes in the tail body tube is 1.1" from the base (not 1.0").

PP. 25 - Diameter of shell mouth is 1.4"ID

- Inside threads on the mouth of the shell are 1½"x12 threads per inch (not 1½x11 TPI).

- Body OD at the base is .95" (not shown).

- Inside radius of the Bourrelet section is .9" (not 1.0"). Wall thickness in this section should be held to .23" min./.28" max.

The info presented in part one of this article (Vol II, No.1) was based on measurements taken from a 60 mm practice round. I have since obtained copies of government machinist drawings for the 60 mm round. This material was de-classified after WW II, so PMA is free to reprint it. The set of copies was both incomplete and illegible in several spots. I've drawn the missing pieces with estimated dimensions. Included are several notes to clarify unreadable items.

Readers familiar with working from blueprints should have no trouble. If your needs are for a more simplified set of dimensions, the chart on page seven of issue one can be used. Round off the four place decimal numbers to simple fractions.

Example: The plans specify the fuze body length as 1.77"-.02" long. The engineer has allowed the finished length to vary from 1.77"(max)to 1.75"(min). You may find it appropriate to simply list the finished length as 1.75" or even 1-3/4".

I've devoted a great deal of space to this material because the information can be applied to a variety of other weapons projects.

Example: Compare the specs for the rough shell castings and forging (pg.58) with the dimensions of the finished shell (pg.59). Note that the dimensions for the shell interior must be correct after casting or forging, as no further machine work is done inside the shell. On the other hand, all exterior surfaces are cast or forged oversized to allow for final shaping on a lathe. The relationsip of the rough and finished measurements can be used as a guideline when designing molds, cores and forging tools for similar projects.

Notes on Filler and Booster Charge:

TNT (Trinitrotoluene) is produced from toluene, sulfuric acid, and nitric acid. It is a powerful high explosive with a velocity of detonation of about 21,000 feet per second. It is well suited for steel cutting, concrete breaching, and general demolition.

TNT is relatively insensitive to shock. It will not detonate on the strike of a single rifle bullet, but may do so under sustained machinegun or rifle fire.

TNT may vary in color from a pale yellow to an orange. Its color is influenced by time and by the purity of the explosive.

TNT is crystalline and is issued in pressed form. It can be steam melted. It burns at 266° F. Small quantities (up to 1 pound) of it may be burned in open areas without fear of detonation.

TNT is toxic; TNT dust should not be inhaled in quantity or allowed to contact the skin excessively. The gases produced by an explosion of TNT are poisonous.

Tetryl

Tetryl (trinitrophenylmethylnitramine) is a fine, yellow crystalline which is more powerful than TNT. Pure tetryl is too shocksensitive to be used as a demolition explosive; however, when small quantities are compressed into pellet form it is perfectly safe. Tetryl booster pellets are commonly used in bursting projectiles to assure the detonation of a less sensitive filler explosive. Tetryl is also compounded with TNT to form the demolition explosive tetryol.

Tetryl is practically nonhygroscopic and is insoluable. Tetryl will detonate if exposed to a temperature of 500° F.

SHELL BODIES - STEEL GRADES

Type A-Forging-WD 55-1 carbon 0.18-.028%
Type B-Rolled Plate - WD 1020 Steel
Type D-Casting-Cast Steel
Type F-Stamped and Drawn Plate
Type G-Stamping-WD 1010 Steel

AA - Casting Shell Bodies

Most small shops will not be able to produce steel castings, and will have to use gray iron, brass or an aluminum alloy. Iron is prefered, but most home foundries are set to pour brass and aluminum only. One furnace capable of melting iron is featured on pg.73 of this issue. Use of alternate shell body materials will require slight adjustments in dimensions to maintain proper weight, shell capacity and wall strength.

BB - Forging Shell Bodies

The above furnace (pg.73)will also be sufficient to allow hot forging. Refer to Vol II, No.1 for info on shell forging in the small shop. The 60mm shell is similar to the 81 mm shell shown.

CC - Dieforming Shell Bodies

The info for dieforming shell bodies was not included in set of drawings. In general, body halves are pressed from flat pieces of sheet steel. The completed halves are joined by welding as outlined on page 59. As with the other types of shell production, all interior dimensions should be correct after pressing. After welding the outside is machined to the specs on page 59.

DD - Shell Body OD - CRITICAL

The mortar barrel is constructed from 2.75 OD-2.375 ID steel seamless mechanical tubing. Manufacturing tolerances require tubing ID to be honed to .005"/.010" oversized (2.380"+.005"). It is therefore critical that finished shell bodies (including painting and marking) are able to slip through a 2.364" max ID ring gage. Max OD of completed tail assembly is 2.375"-.005".

EE - Thread Cutting

The following sizes of taps and dies are needed to complete the 60mm mortar round. Items marked NF (National Fine)are available from most auto supply or hardware stores. Those marked NS (non-standard)are special sizes that must be obtained from tool suppliers like B-Square Co. (see Vol II,No.1, pg.13) or Field Tool Supply Co., 2350 N.Seeley Ave., Chicago, ILLINOIS 60647.

If you are limited to the use of standard NF taps and dies, convert the NS sizes to their NF equivilant as shown in the chart.

Standard Taps/Dies:	
1-1/2x12 NF	-available locally
5/16 x24 NF	- " "
1/4 x28 NF	- " "

Special Tap/Dies:		
1-1/8x20 (NS)	or use	1-1/8x12 NF
9/16 x24 (NS)	" "	9/16 x18 NF
3/4 x18 (NS)	" "	3/4 x16 NF

In lieu of taps/dies, all thread cutting,(except in the three small holes in the fuze body) can be done on a thread cutting lathe.

FF - Machining

Almost all remaining machine work, including all small parts, can be done on a metal cutting lathe. All holes can be drilled with a drill press. A rotary indexing table for the drill press is not essential, but it simplifies locating the various holes in the fuze body in proper relation to each other. (90° and 40° from reference lines).

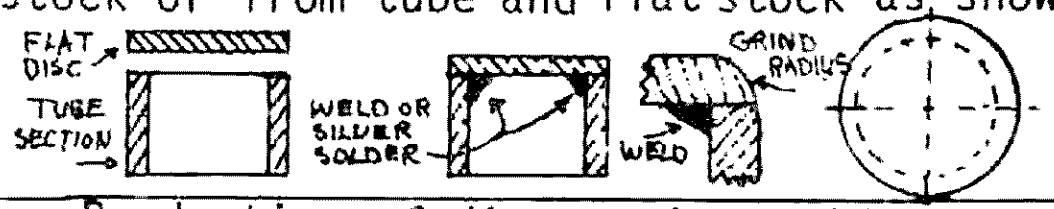
The only flat machining required is slotting and milling a flat on the slider assembly. This can also be done w/a file or hand grinder or by clamping the piece in a horizontal feed unit on a drill press. The work is fed into a grinding stone mounted in the drill's chuck.

Note that various parts can be made from aluminum, zinc, brass or steel, depending upon availability.

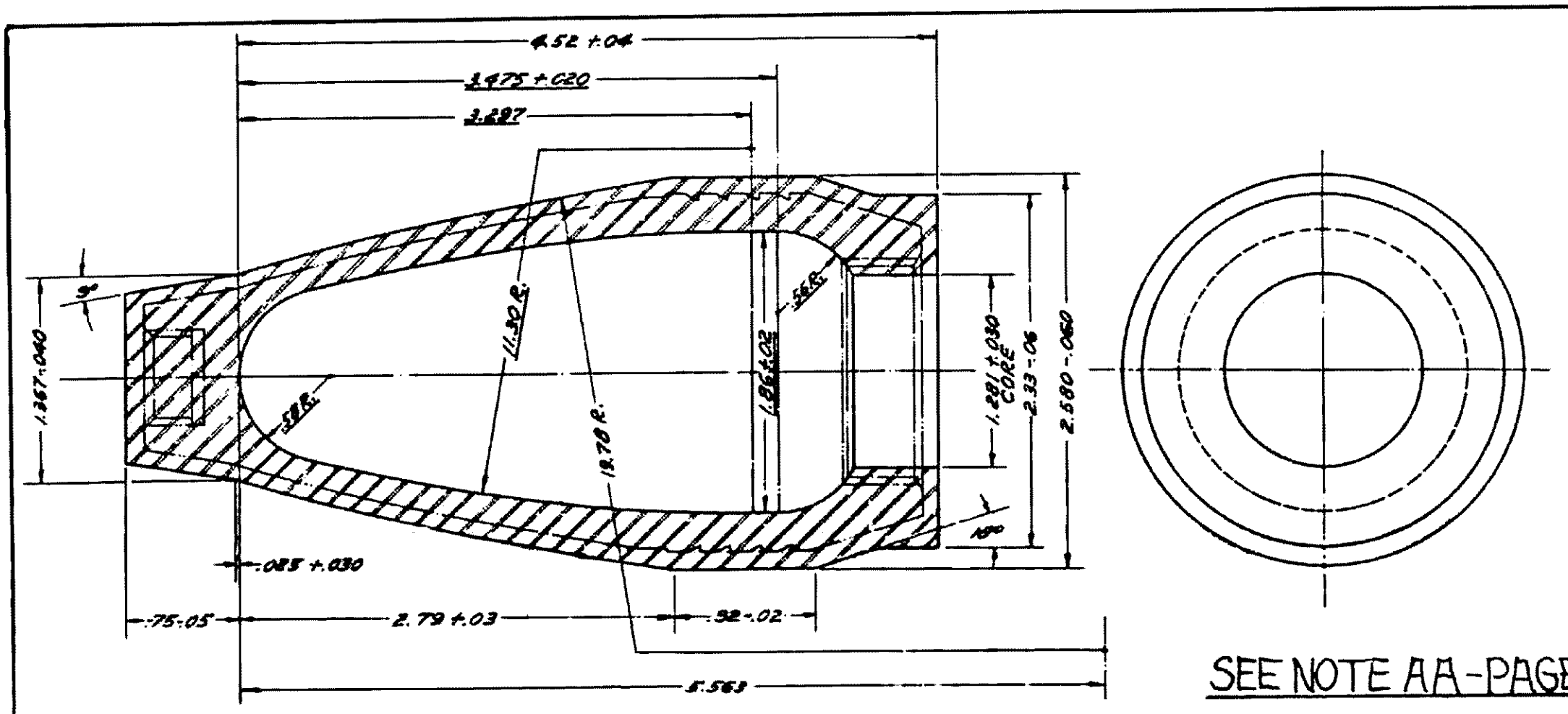
Spring making is a complex process. Appropriate springs should be obtained readymade to insure reliability.

GG - Die Forming/Die Casting

Punch and die info for stamping out and forming the striker and booster cup will be covered in Vol II, No.3 & 4.These parts can also be machined from solid stock or from tube and flat stock as shown.



Production of die casting molds for the fuze body and head assemblies are beyond the scope of the small shop. These pieces can be produced as oversized sand castings machined to finished size.



SEE NOTE AA-PAGE 57

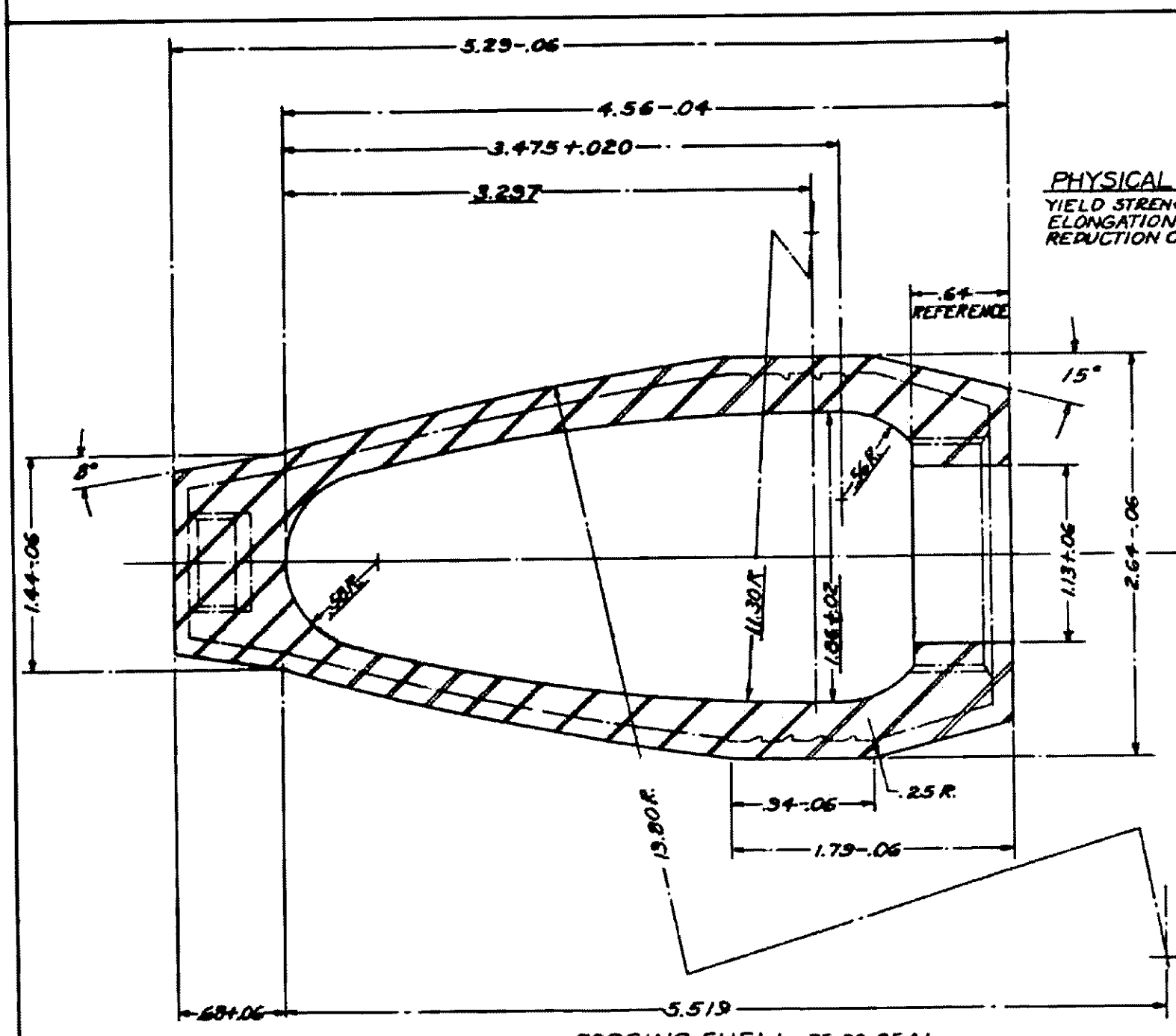
CASTING, SHELL 75-20-83A

NOTES:-
A - MAXIMUM PERMITTED ECCENTRICITY BETWEEN CAVITY OF SHELL AND OUTSIDE SURFACE AT ANY POINT, .065. (WHEN MEASURING ECCENTRICITY BY MEANS OF A DIAL INDICATOR THE TOTAL READING ON THE DIAL IS TWICE THE ECCENTRICITY.)
B - CASTING TO WITHSTAND AN INTERNAL AIR PRESSURE TEST OF 250 LBS. PER SQ. IN.
C - DOT AND DASH LINES INDICATE FINISHED SHELL.
D - UNDERLINED DIMENSIONS ARE FINISHED SIZES AND WILL NOT BE MACHINED.
E - CAVITY MUST BE FREE FROM SCALES, PITS, SEAMS, LAMINATIONS, CRACKS, BLOW HOLES, POCKETS, SAND, OR OTHER IMPERFECTIONS. THE FINISH OF THE CAVITY SURFACE MUST BE THE EQUAL OF A FINISH BORED CAVITY.
F - CAPACITY OF CAVITY AS CAST SHALL BE 8.85 CU. IN. APPROX.
G - IF MANUFACTURER OF CASTING IS ALSO MANUFACTURER OF THE SHELL; DIMENSIONS OF CASTING MAY BE VARIED TO GIVE ALLOWANCES FOR MACHINING AS REQUIRED BY HIM.

WEIGHT OF CASTING = 2.90 POUNDS MAX.

CASTING FOR SHELL, H.E. 60 MM, M49A2 AND PRACTICE, 60MM, M50A2

75	20	83



PHYSICAL PROPERTIES

YIELD STRENGTH	NOT LESS THAN 35,000 LBS. PER SQ. IN.
ELONGATION IN 2 INCHES	NOT LESS THAN 15%
REDUCTION OF AREA.	NOT LESS THAN 30%

SEE NOTE BB-PAGE 57

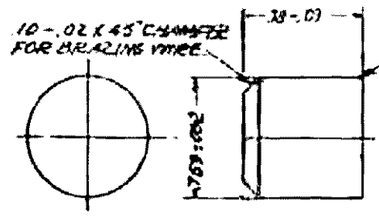
FORGING, SHELL 75-20-85A1
STEEL

MAX. WEIGHT OF FORGING = 3.33 LBS.

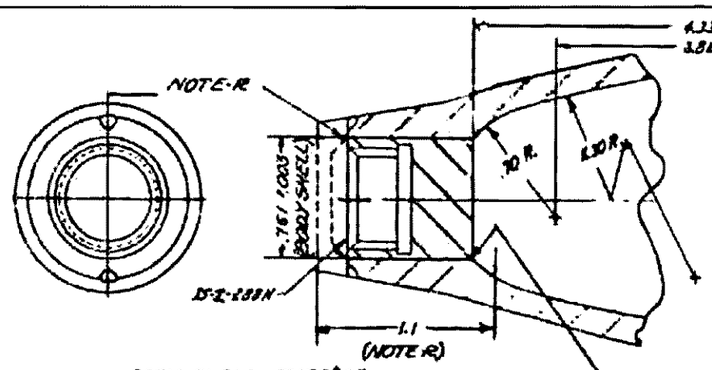
NOTES:
A. UNDERLINED DIMENSIONS ARE FINISHED SIZES AND WILL NOT BE SUBSEQUENTLY MACHINED.
B. DOT AND DASH LINES REPRESENT FINISHED SHELL.
C. MAXIMUM PERMITTED ECCENTRICITY BETWEEN SHELL CAVITY AND OUTSIDE SURFACE AT ANY POINT, .04 (WHEN MEASURING ECCENTRICITY BY MEANS OF A DIAL INDICATOR, THE TOTAL READING ON THE DIAL IS TWICE THE ECCENTRICITY).
D. IF MANUFACTURER OF FORGING IS ALSO MANUFACTURER OF THE SHELL; DIMENSIONS OF FORGING MAY BE VARIED TO GIVE ALLOWANCES FOR MACHINING AS REQUIRED BY HIM.

FORGING FOR SHELL, H.E. 60MM, M49A2 AND PRACTICE, 60MM, M50A2

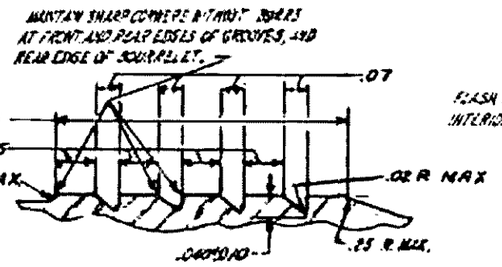
75	20	85



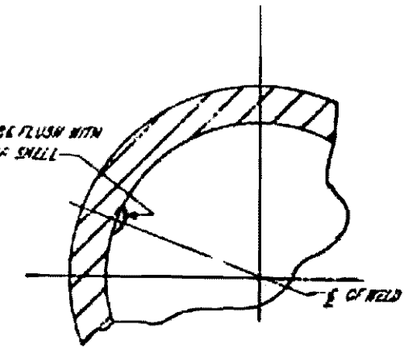
PLUG, BASE 15-P-288N8
STEEL, COLD DRAWN, 1020



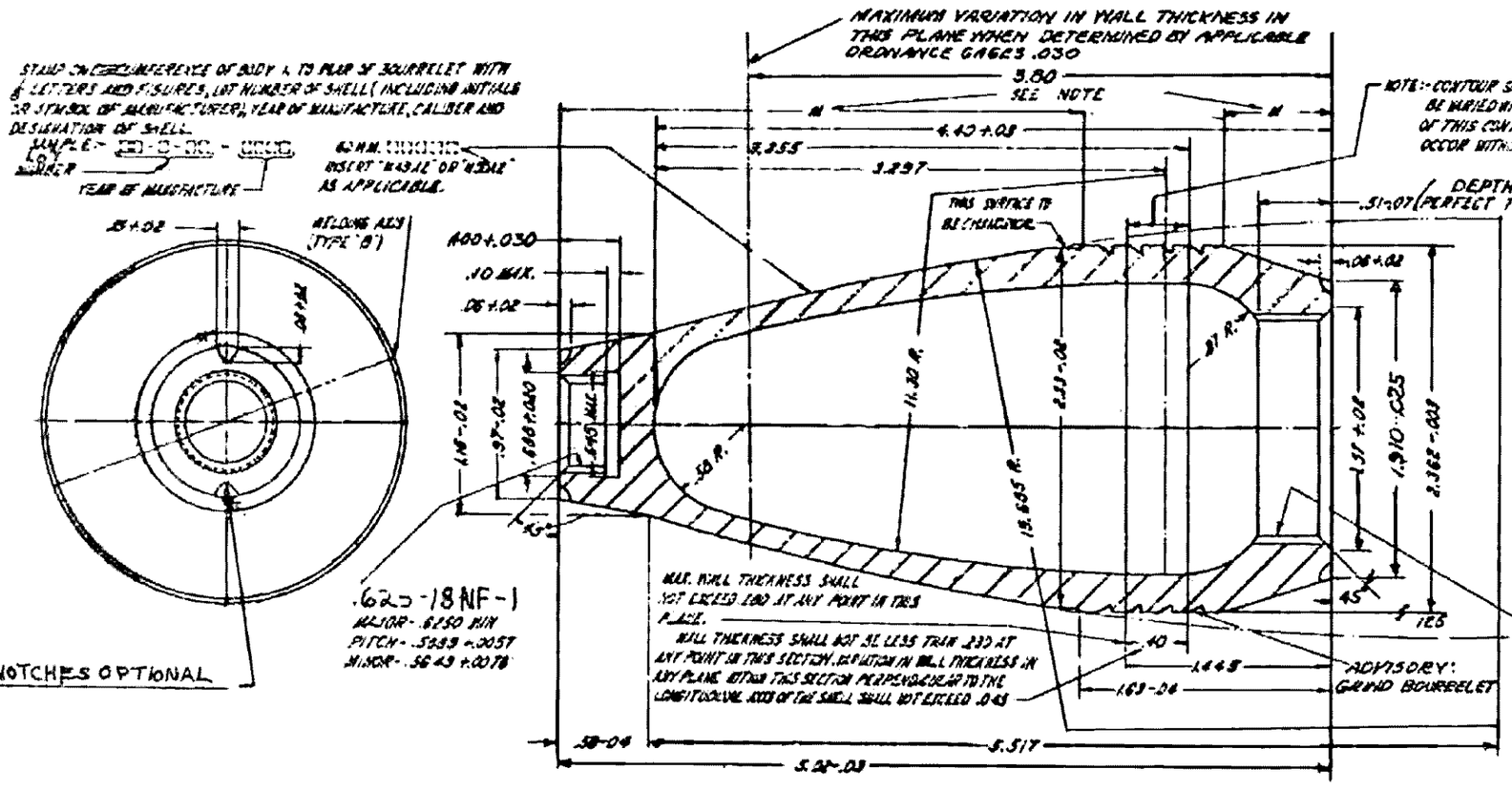
BODY, SHELL, TYPE "S"
STEEL, STAMPING
FOR ALL OTHER SPECIFICATION SEE BODY, TYPE A.



DETAIL OF GROOVES IN BOURRELET



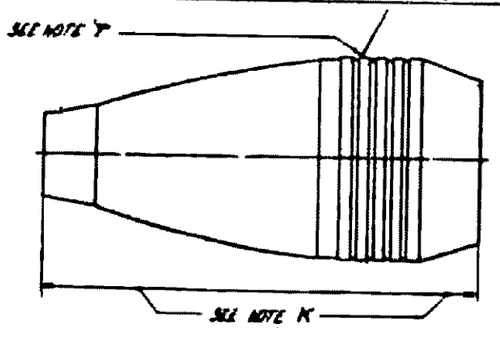
SECTION THRU WELDED AREA (TYPE B)



SEE NOTE CC-PAGE 57

BODY, SHELL
FINISH OUTSIDE "S"

SEE NOTE DD-PAGE 57



METAL PARTS SHIPPING ASSEMBLY 75-2-288C 10

NOTES:-
A - MEAN VOLUME OF CAVITY TO BE FILLED WITH .67 CUBIC APPROX.
B - MEAN DIMENSIONS USED FOR COMPUTING WEIGHTS.
C - TOLERANCE ON CAPACITY ESTABLISHED BY TOLERANCE ON DIMENSIONS.
D - WEIGHT TOLERANCE NOT EQUIVALENT TO DIMENSION TOLERANCES. CONTROL DIMENSION TOLERANCES TO DESIRED SHELL BODY WEIGHT BY GAGE.
E - DIMENSIONS FOR WHICH TOLERANCES ARE GIVEN WILL NOT BE INDIVIDUALLY GAGED.
F - SHELL MUST BE CAREFULLY CENTERED DURING VARIOUS MACHINING OPERATIONS IN ORDER TO MAINTAIN CONCENTRICITIES OF CYLINDRICAL SURFACES. THE ALLOWABLE MINIMUM ECCENTRICITIES OF CYLINDRICAL SURFACES WILL BE ACCEPTED. (WHEN MEASURING ECCENTRICITY BY MEANS OF A DIAL INDICATOR THE TOTAL READING OF THE DIAL IS TWICE THE ECCENTRICITY)
1 - BETWEEN THE NOSE THREADS, FUZE SEAT THREADS AND OUTSIDE CYLINDRICAL SURFACES, .31 TIR. (WHEN TAKEN BETWEEN BOURRELET, WITH NOSE THREADS AND BASE THREADS, TOLERANCE INCLUDES OUT OF SQUARENESS OF FACES.)
G - PRIOR TO PAINTING, CLEAN SHELL SURFACES IN ACCORDANCE WITH GRADE II, SPEC. MIL-C-490.
N - COAT INTERIOR SURFACES OF SHELL EXCEPT THREADS WITH ACID-PROOF BLACK PAINT, TYPE I OR II.
K - COAT EXTERIOR SURFACE OF SHELL, EXCEPT NOSE AND GAGE, WITH LACQUER ENAMEL OR ENAMEL, OLIVE DRAB.
M - FOR SHELL TYPE "B" THESE SURFACES NEED NOT BE MACHINED EXCEPT FOR REMOVAL OF WELDING FLASH, MAINTAINING TRUE CONTOUR OF SHELL.
P - AT NO POINT SHALL WALL THICKNESS BE LESS THAN .105
R - SILVER BRAZE 360° WITH ASSEMBLING PLUG. LOCALIZE BRAZING HEAT IN REGION SPECIFIED BY MEANS OF INDUCTION HEATING. MINIMUM ALLOWABLE QUANTITY OF SILVER SOLDER WIRE TO BE .073 MIN. DIA. & 2.2 LONG. PLUG TO BE BRAZED BEFORE MACHINING OF PLUG CAVITY AND EXTERIOR OF SHELL.
S - MAXIMUM ALLOWABLE GAP IN MEASURING OUT OF SQUARENESS OF THREAD AXIS WITH SHELL NOSE FACE WHEN DETERMINED BY APPLICABLE ORDNANCE GAGES, .003
T - BOURRELET AFTER POINTING MUST PASS A 1.364 MAX. DIAMETER RING GAGE.

TYPE "A" - PRODUCED FROM FORGING.
TYPE "B" - PRODUCED BY CUPPING SPECIALLY ROLLED PLATE AND WELDING LONGITUDINALLY.
TYPE "D" - PRODUCED FROM STEEL CASTING.
TYPE "F" - PRODUCED BY STAMPING AND DRAWN FROM STEEL PLATE.
TYPE "G" - PRODUCED BY STAMPING AND DRAWN FROM STEEL PLATE, BUT INCORPORATING BASE PLUG SILVER BRAZED IN PLACE (SEE GAR 419).

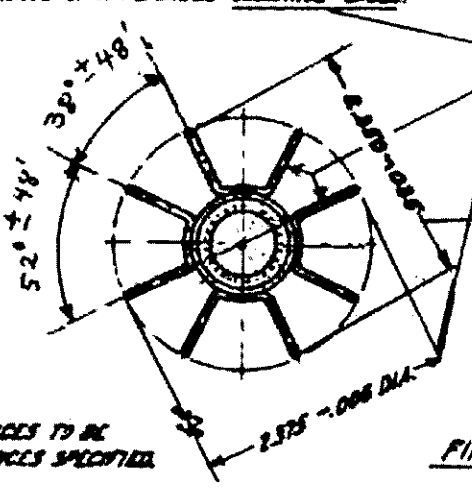
TYPE	PIECE MARK	TYPE	PIECE MARK
"A"	23-Z-288A 10	"B"	75-Z-2886 10
"B"	75-Z-288B 10		
"D"	25-Z-288D 10		
"F"	25-Z-288F 10		

SHELL, H.E., 60MM, M49A2 AND PRACTICE, 60MM M30A2, METAL PARTS SHIPPING ASSEMBLY & DETAILS.

75	2	288

LONGITUDINAL ALIGNMENT OF FIN BLADES WITH PITCH DIAMETER OF .625-18 NS-2 THREAD AND FORWARD SEATING SHOULDER TO BE WITHIN LIMITS OF APPLICABLE ORDNANCE CABLE.

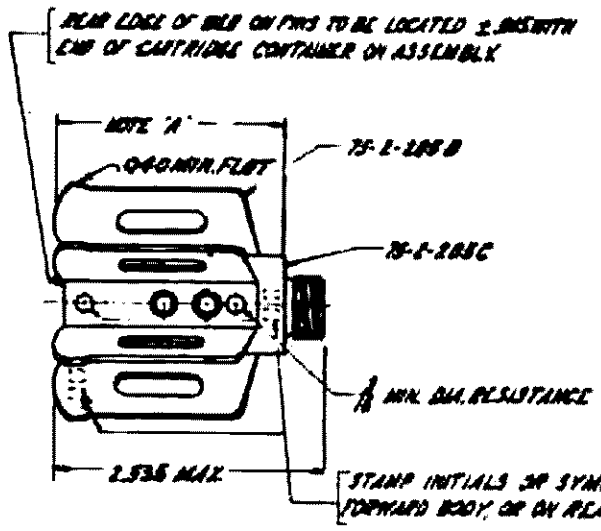
COMPLETED ASSEMBLY MUST PASS THROUGH A 2.375 MAX. I.D. RING GAGE - THIS IS CRITICAL!



THESE DIAMETERS MAY VARY WITH RESPECT TO EACH OTHER BUT PROJECTIONS ON ALL BLADES SHALL EXTEND MINIMUM OF .005 ABOVE 2.350-.015 DIAMETER SURFACES

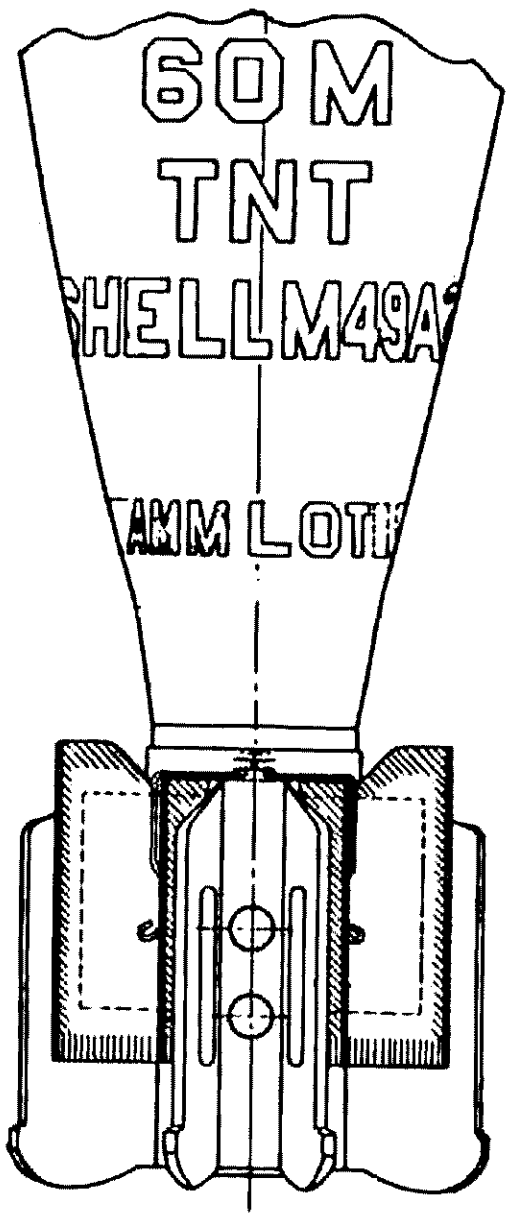
ALL LIGHT SURFACES TO BE WITHIN TOLERANCES SPECIFIED.

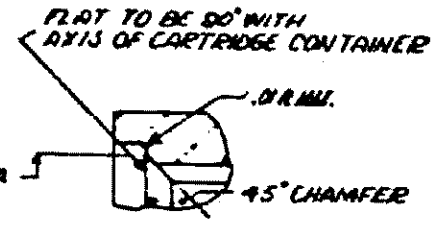
FIN ASSEMBLY 75-2-285 A12



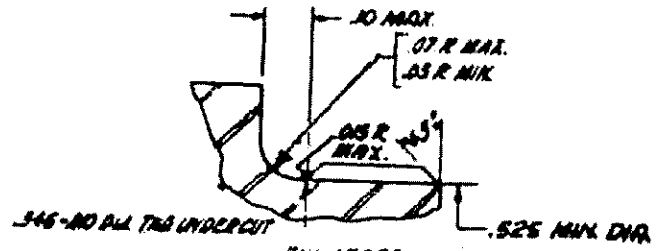
NOTES:-
A- COAT ENTIRE EXTERIOR SURFACE, EXCEPT FORWARD THREADS AND SEAT, AND REAR COUNTERBORE, WITH OLIVE DRAB LACQUER ENAMEL OR ENAMEL. INTERIOR OF CARTRIDGE CONTAINER NOT TO BE PAINTED. (ml)
B- ECCENTRICITY BETWEEN THE 2.375-.008 DIA OF FIN BLADES AND PITCH DIA. OF .625-18 NF-2 THREADS OF PC MK 75-2-285C, .005; I.E. A DIAL INDICATOR READING OF .01. TOLERANCE INCLUDES OUT-OF-SQUARENESS OF FORWARD SEATING SHOULDER (F)
C- ECCENTRICITY BETWEEN PITCH DIA OF .75-18 NS-2 THREAD AND PITCH DIA. OF .625-18 NF-2 THREAD OF PC MK. 75-2-285C, .010 MAX., I.E. A TOTAL DIAL INDICATOR READING OF .020.
D- COAT CAVITY AND THREADS WITH CLEAR LACQUER ENAMEL OR PHENOL FORMALDEHYDE RESIN VARNISH. THICKNESS OF COATING ON THREADS MUST NOT EXCEED .0005 IN.

NOTE: REFER TO PAGE 23-VOL. TWO / #ONE



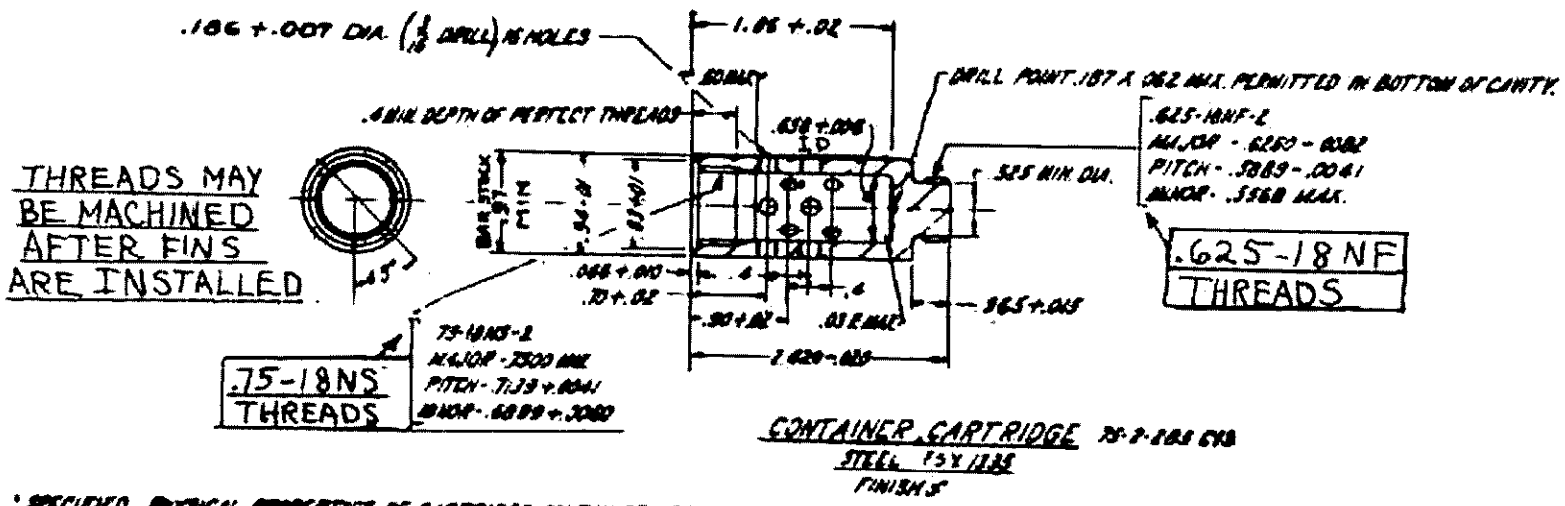


ENLARGED VIEW OF REAR COUNTERBORE



.346-.110 DIA. THIS UNDERCUT

ENLARGED VIEW

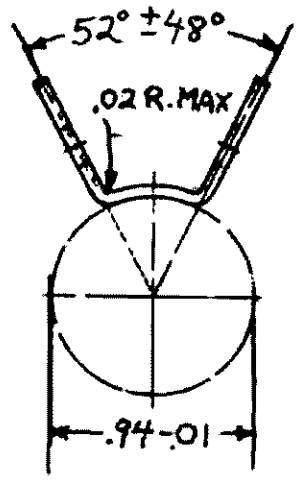


CONTAINER, CARTRIDGE 75-2-285 C18
STEEL FSX 1335
FINISH S*

* SPECIFIED PHYSICAL PROPERTIES OF CARTRIDGE CONTAINER ARE REQUIRED IN COMPLETED ASSEMBLY. USE OF STEEL BARS WITH ELONGATION OF 12 PERCENT MINIMUM IS PERMITTED WHEN BARS HAVE NOT BEEN STRAIN ANNEALED.

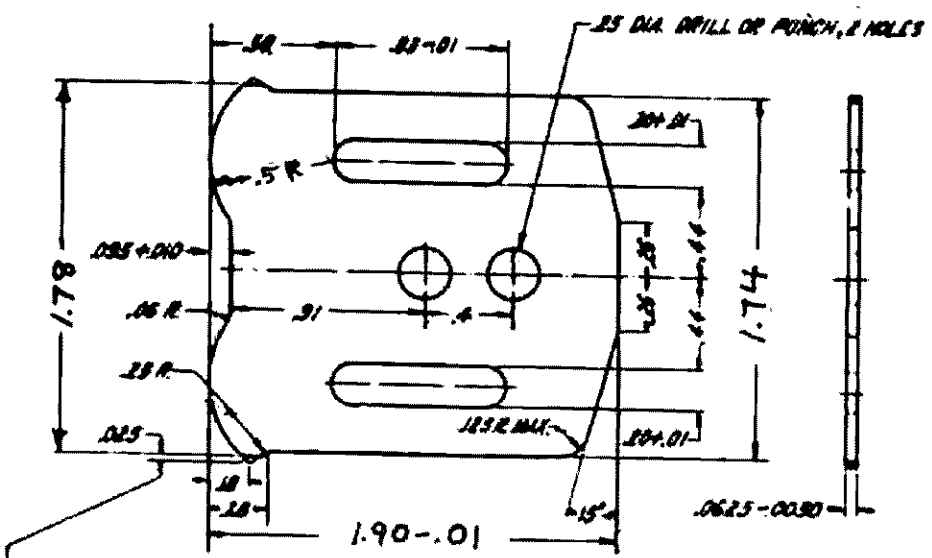
NOTE-
ECCENTRICITY BETWEEN THE .94-.01 DIA SURFACE AND PITCH DIA. OF .75-18NF-2 THREAD, .005 MAX., I.E., A TOTAL INDICATOR READING OF .010

PHYSICAL PROPERTIES (A)
YIELD POINT - 75000 LBS. PER SQ. IN. MIN.
ELONGATION - 15% MIN.
RED - 35% MIN.



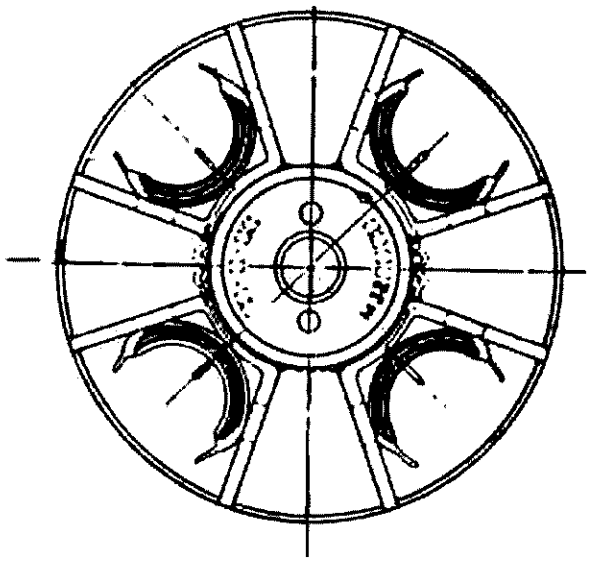
FIN 75-2-285 B10
STEEL MIL-S-5000
SMOOTH, SEMI-GLOSS

PHYSICAL PROPERTIES
YIELD POINT - 45,000 LBS. PER SQ. IN. MIN.
ELONGATION - 12% MIN.
HARDNESS - 85 MIN (ROCKWELL 'B')



EXTRA STOCK OF THIS CONTOUR PERMITTED FOR FINISHING TO 2.375-.005 DIA. ON ASSEMBLY

FIN DEVELOPMENT
(A) TOLERANCES APPLICABLE TO PUNCHES AND DIES.

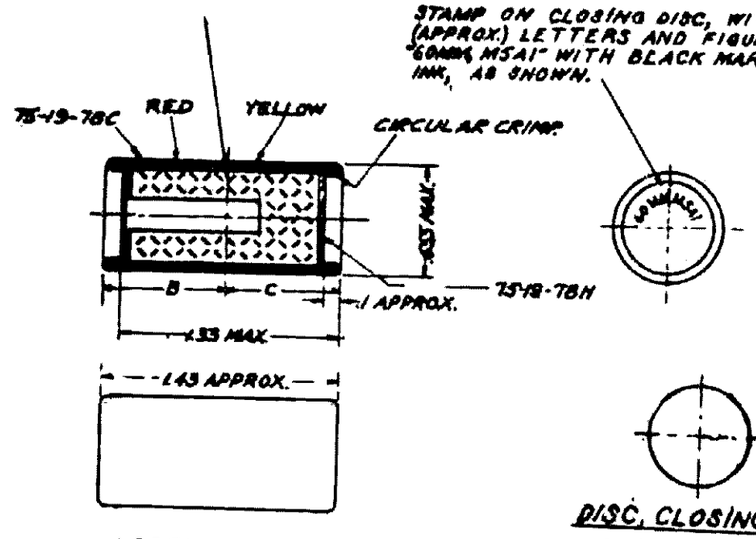


CARTRIDGE CONTAINER AND FIN ASSEMBLY

75 | 2 | 285

CHARGE 75-19-78B3

440 ± 10 GRAINS, PROPELLENT POWDER

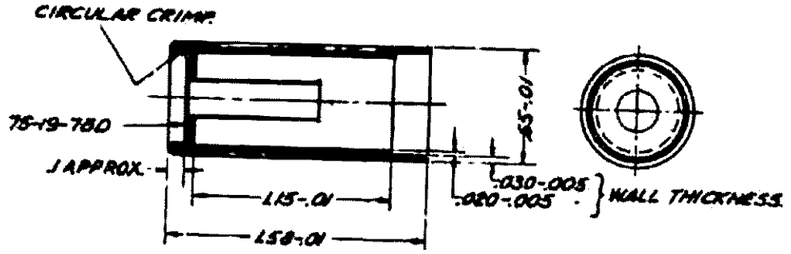


ASSEMBLY 75-19-78A4

NOTE- A- SPRAY CRIMPED ENDS OF CARTRIDGE WITH NITRO-CELLULOSE LACQUER.
B- IGNITION END HALF OF CATRIDGE, COLORED RED
C- OPPOSITE HALF OF CARTRIDGE, COLORED YELLOW

DISC, CLOSING 75-19-78H3

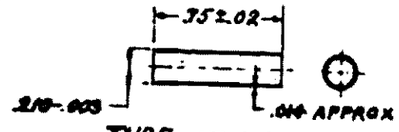
CHIPBOARD, COMMERCIAL



BODY ASSEMBLY 75-19-78C4

BODY TO BE MADE FROM STANDARD COMMERCIAL PARAFFINED CARTRIDGE PAPER, OUTSIDE LAYER COLORED RED AND YELLOW, ADVISORY LENGTH OF OUTER TUBE, UNCRIMPED, 1.74-.01

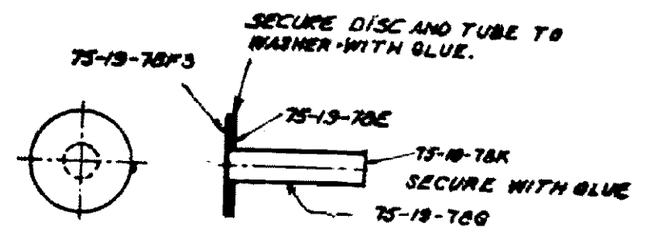
CARTRIDGE, IGNITION, M5A1, FOR 60MM, MORTAR AMMUNITION. ASSEMBLY AND DETAILS



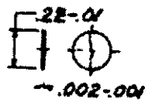
TUBE 75-19-78D4

PAPER.

(PAPER, JUTE, DRAWN OR KRAFT. TUBE TO CONSIST OF APPROX. THREE THICKNESSES OF PAPER.)



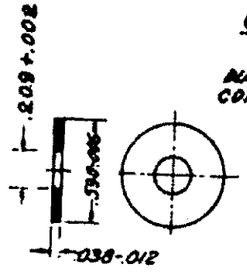
WASHER, TUBE ASSEMBLY 75-19-78D3



COVER 75-19-78K3

ONION SKIN PAPER

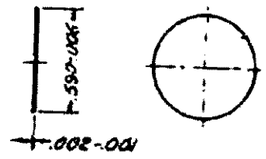
DIAMETER DIMENSION CONTROLS TOOL MANUFACTURE



WASHER 75-19-78E3

CHIPBOARD, COMMERCIAL

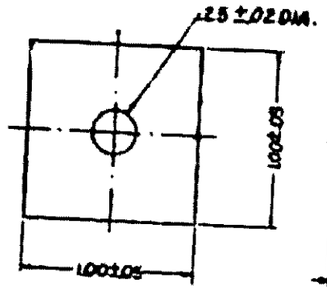
COVER BOTH SIDES OF CHIPBOARD STOCK WITH A THIN COAT OF ORANGE SHELLAC VARNISH, GRADE 3 MEDIUM BODY AND ALLOW TO DRY BEFORE CUTTING WASHER



DISC 75-19-78F

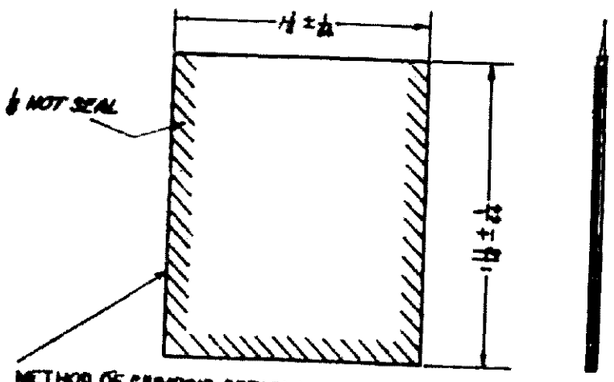
ONION SKIN PAPER

DIAMETER DIMENSION CONTROLS TOOL MANUFACTURE.



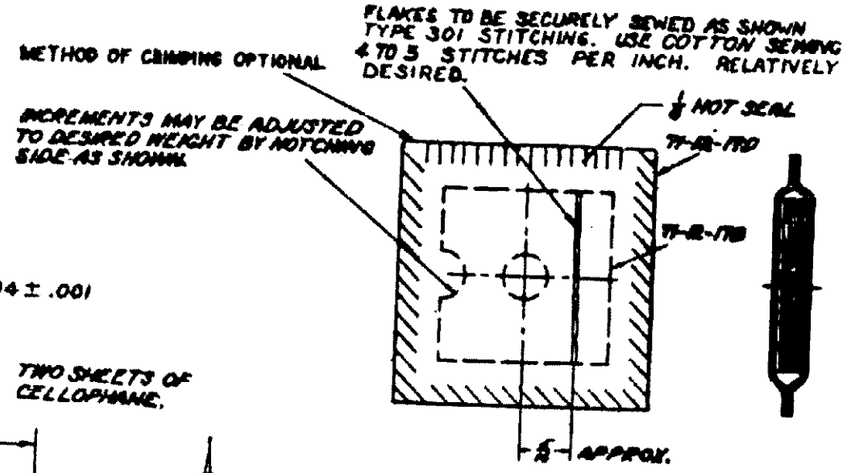
FLAKE, SQUARE

PROPELLANT POWDER



BAG ASSEMBLY

CELLOPHANE



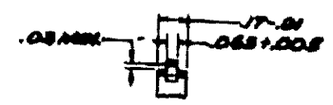
ASSEMBLY 77-18-17C4

WEIGHT- APPROX. 85 GRAINS ± 1 GRAIN

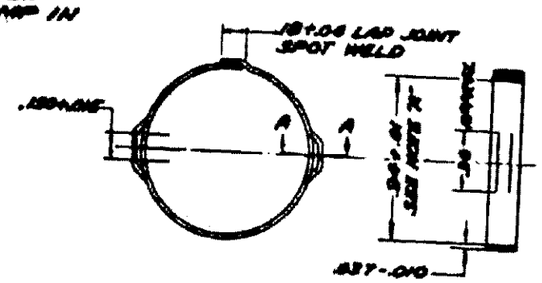
IF SMALL GRAINS OF SMOKE-LESS POWDER ARE USED, FIND A COMBUSTABLE GLUE OR BINDER TO FORM THEM INTO SHEETS AS SHOWN IN SPECS.

INCREMENT, PROPELLENT, M3A1 FOR 60 MM. MORTAR AMMUNITION. ASSEMBLY AND DETAIL.

NOTES:-
A- DIAMETER OF COLLAR TO BE SLIGHTLY OVAL TO ALLOW FOR TOLERANCE ON SHANK OF PIN ASSEMBLY.
B- INSERT CLIP IN SLOT ON COLLAR AND CRIMP IN PLACE SO AS TO HOLD SECURELY.

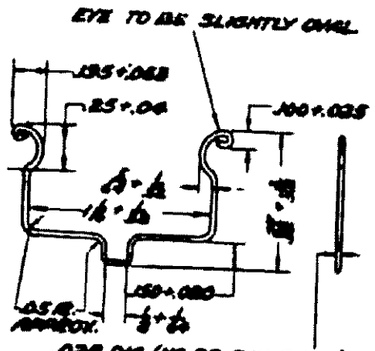


SECTION A-A



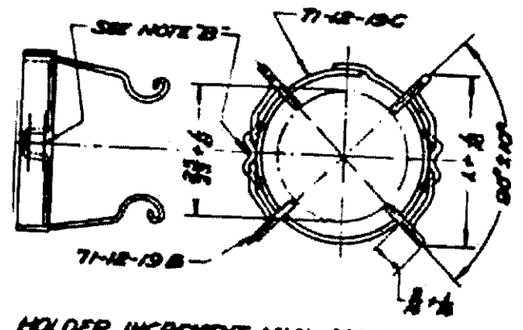
COLLAR 77-18-19C1

STEEL, COLD ROLLED, WR 1010 OR WR 1015
DEVELOPED LENGTH 2.30 APPROX.



CLIP 77-18-19B2

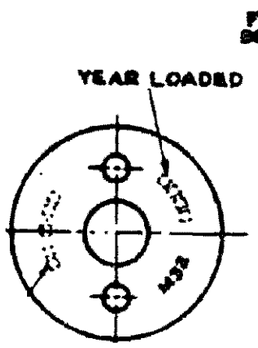
STEEL WIRE WR 1065 OR 1095
DEVELOPED LENGTH= 2.60 APPROX.



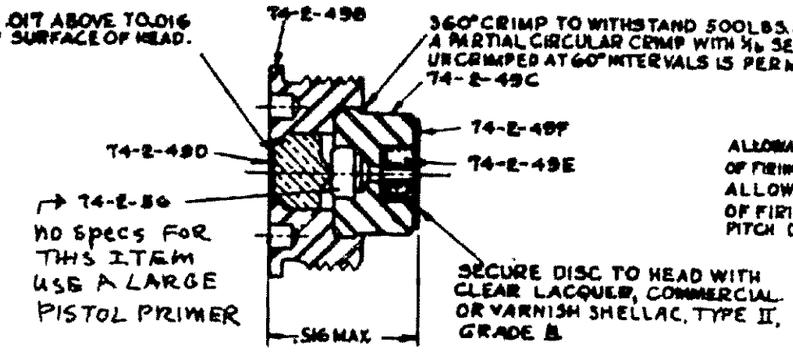
HOLDER, INCREMENT, MW1, ASSEMBLY 77-18-19A2

PMA 61

62 PMA

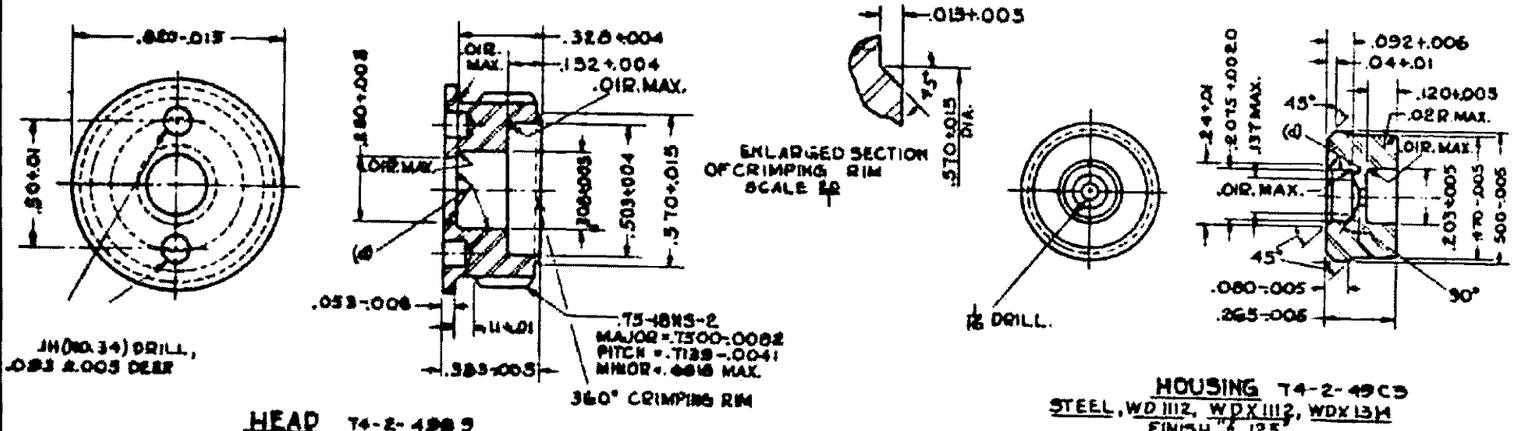


STAMP WITH ☆ LETTERS AND FIGURES, LOT NUMBER DESIGNATION, AND YEAR LOADED



ALLOWABLE ECCENTRICITY BETWEEN CENTERS OF FIRING PLUG CAVITY AND HOUSING CAVITY ±.006
ALLOWABLE ECCENTRICITY BETWEEN CENTER OF FIRING PLUG CAVITY OR HOUSING CAVITY AND PITCH DIAMETER ±.005

ASSEMBLY T4-2-49A10

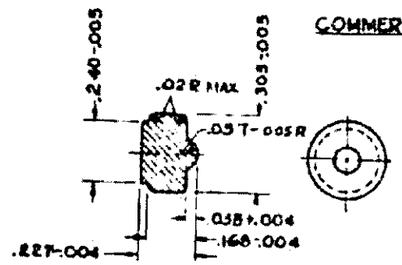


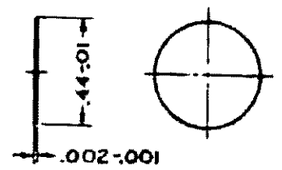
HEAD T4-2-49B9
STEEL, WD 1118, WDX1118, WDX1314
FINISH √ 125"
(d) FINISH √ 63"

HOUSING T4-2-49C9
STEEL, WD 1112, WDX1112, WDX1314
FINISH √ 125
(d) FINISH √ 63"

PLUG, FIRING T4-2-49D10

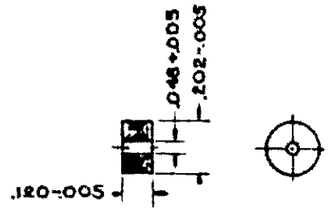
COMMERCIAL BRASS, ROD, COMPOSITION "B" HALF HARD
FINISH √ 63"





DISC T4-2-49F

ONION SKIN PAPER
DIAMETER DIMENSION CONTROLS TOOL MANUFACTURE.



PELLET T4-2-49E10

165-17 GRAINS (107.-11 MILLIGRAMS)
GRADE A5
ADVISORY SPECIFIC GRAVITY 1.80

BLACK POWDER

PRIMER PERCUSSION, M32 ASSEMBLY AND DETAILS

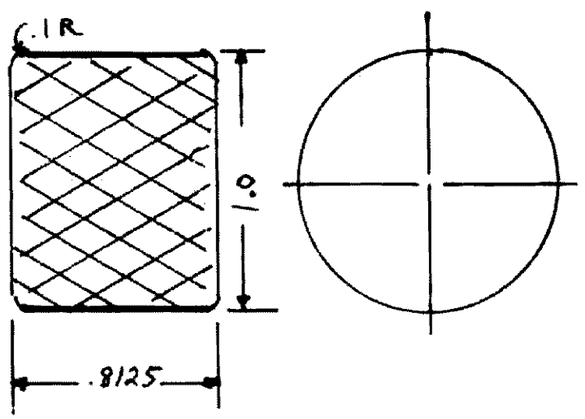
74	2	49

BOOSTER AND DETONATOR

ASSEMBLY AND DETAILS 73-1/73-2

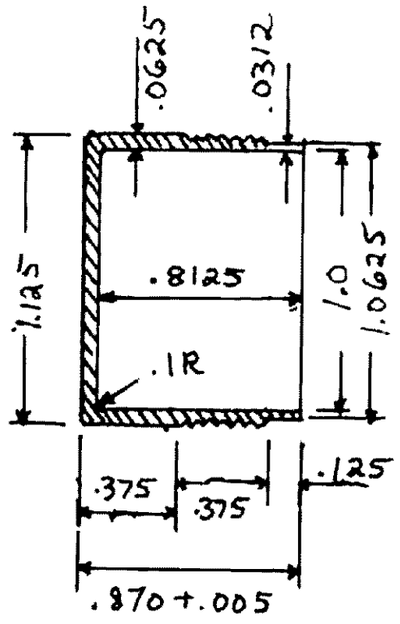
TETRYL WEIGHTS ARE GI SPECS

REMAINING SPECS ARE ESTIMATES ONLY



BOOSTER PELLET 73-1-164Z

256.0 GRAINS TETRYL
PRESS INTO BOOSTER CUP

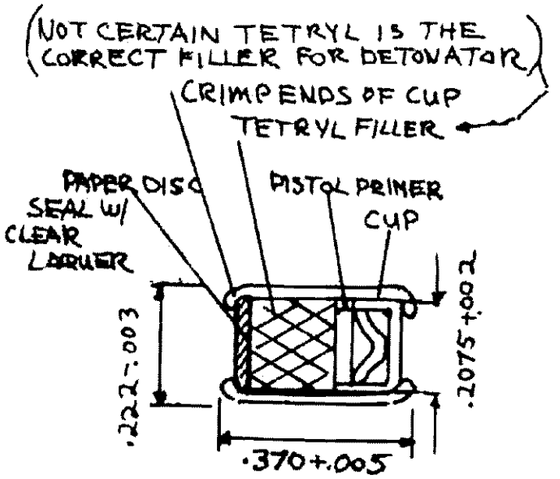


BOOSTER CUP 73-1-164F

ALUMINUM BASE ALLOY CASTING

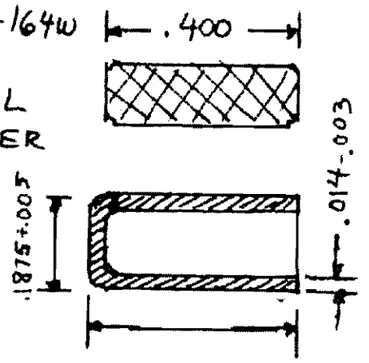
BOOSTER LEAD CUP CHARGE 73-1-164W

3.86 GRAINS TETRYL PRESSED INTO BOOSTER LEAD CUP



M18 DETONATOR ASSEM. 73-2-165A

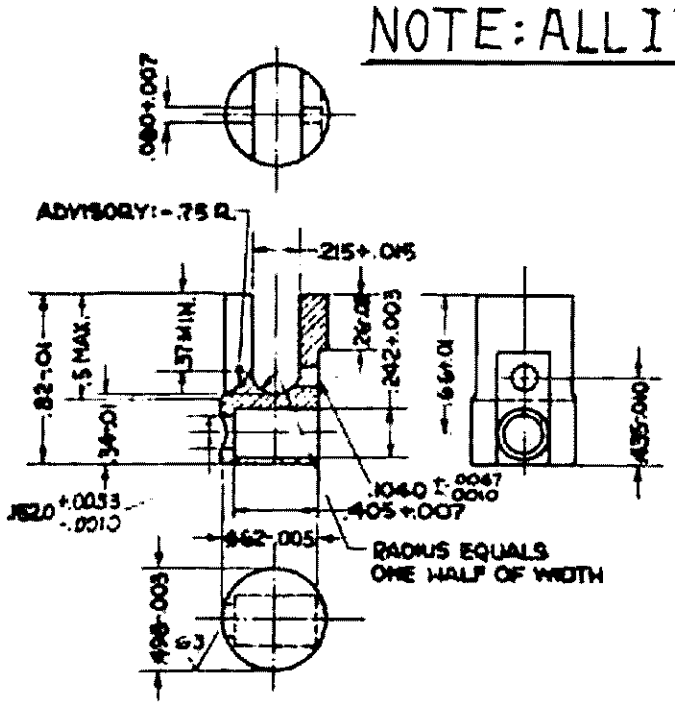
GILDING METAL
COAT PRIMER W/ GREEN LAQUER



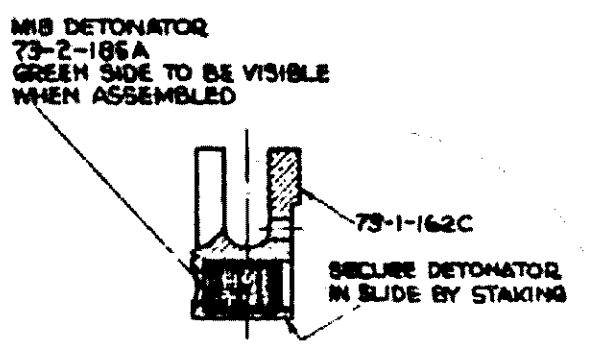
BOOSTER LEAD CUP 73-1-164X

GILDING METAL

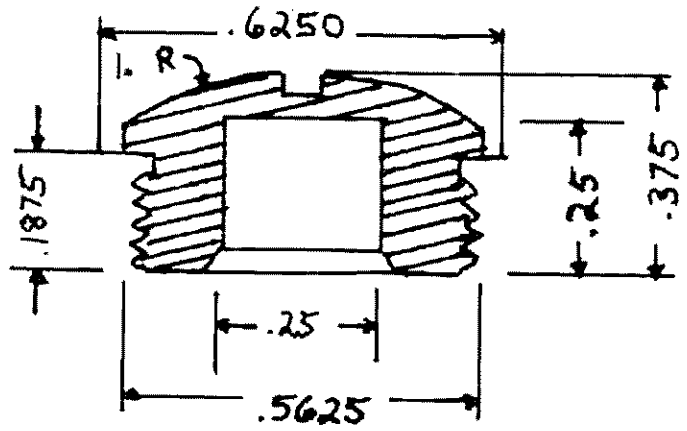
NOTE: ALL ITEMS WITH * ARE ESTIMATES ONLY - NOT GI SPECS



SLIDER 73-1-162C11
COMMERCIAL BRASS, ROD, COMPOSITION "B", HALF HARD
125/ ALL OVER EXCEPT AS NOTED.

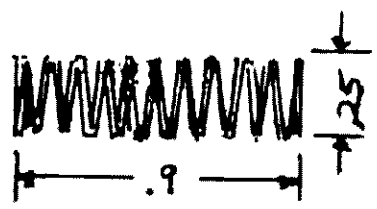


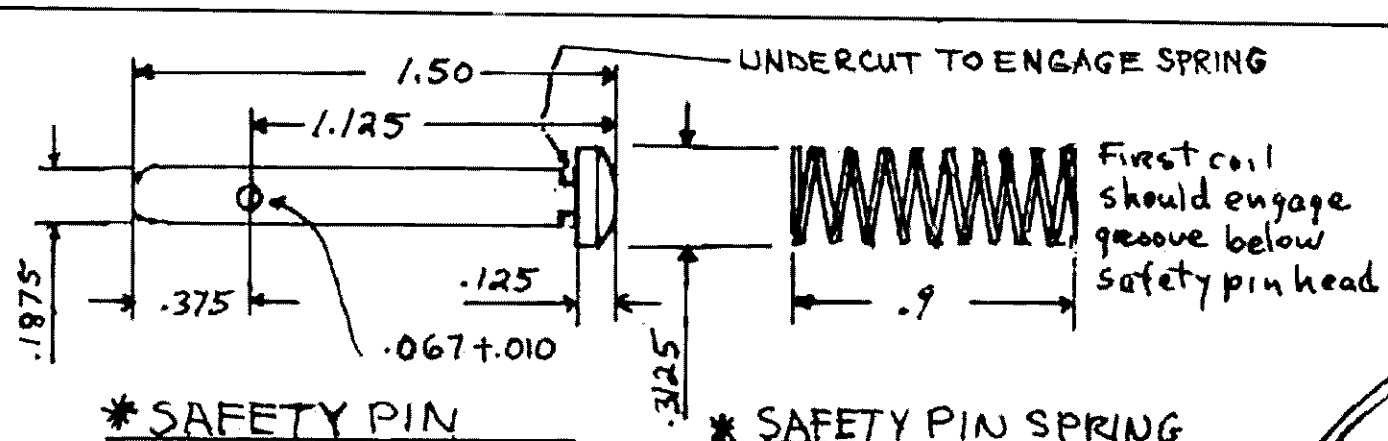
SLIDER ASSEMBLY 73-1-162W



*** SLIDER PLUG** 73-1-163F BRASS
.5625 X 24 TPI (NON-STAN.)

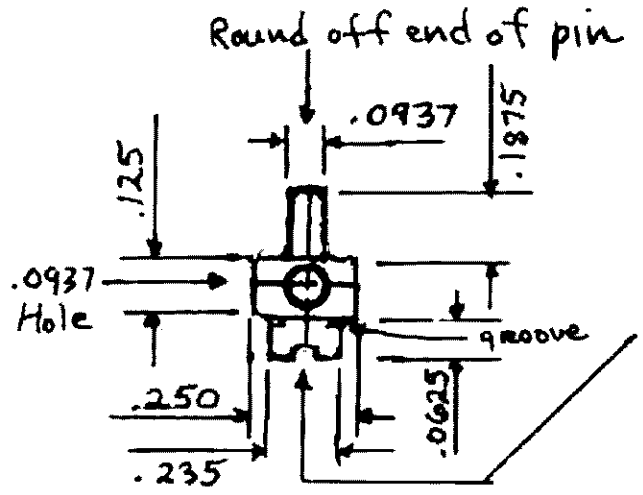
*** SLIDER SPRING**
73-1-163H
Steel wire





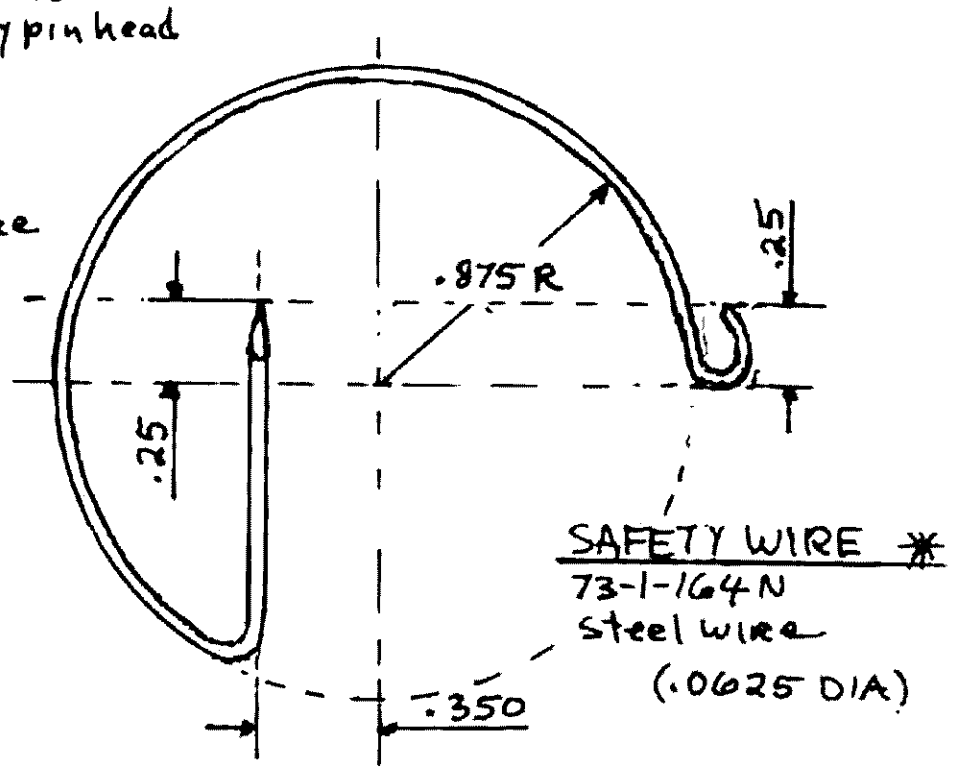
*** SAFETY PIN**
73-1-163E BRASS ROD

*** SAFETY PIN SPRING**
73-1-163G - Steel wire

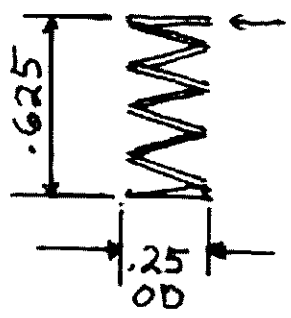


SETBACK PIN *
73-1-163-B
steel bar

Cut screwhead slot for alignment of hole after installing in fuze body



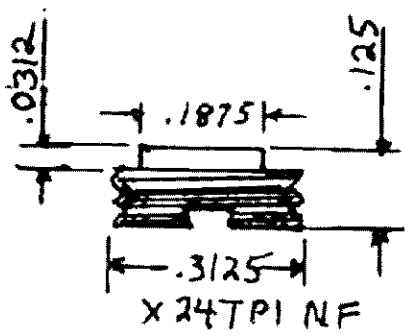
SAFETY WIRE *
73-1-164N
Steel wire
(.0625 DIA)

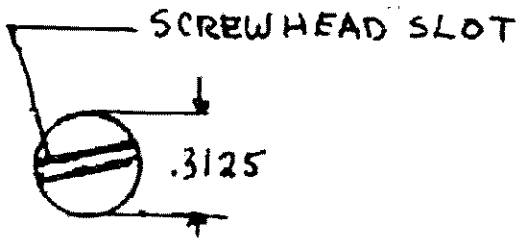


← First coil should engage groove in set back pin

max. of 6 oz. for full compression

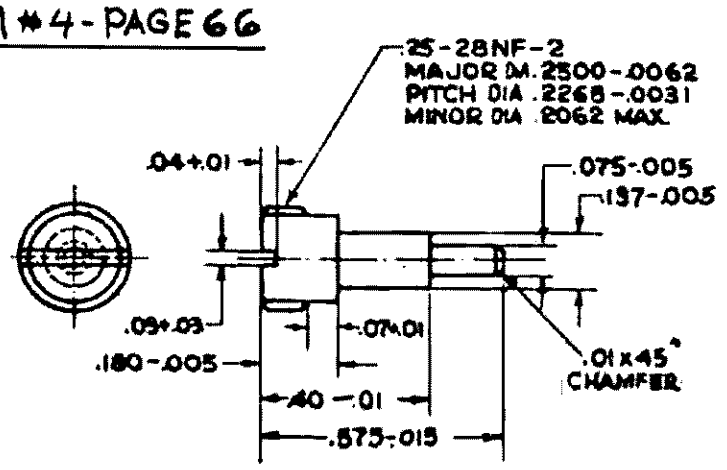
SETBACK PIN SPRING *
Steel wire - 73-1-163D





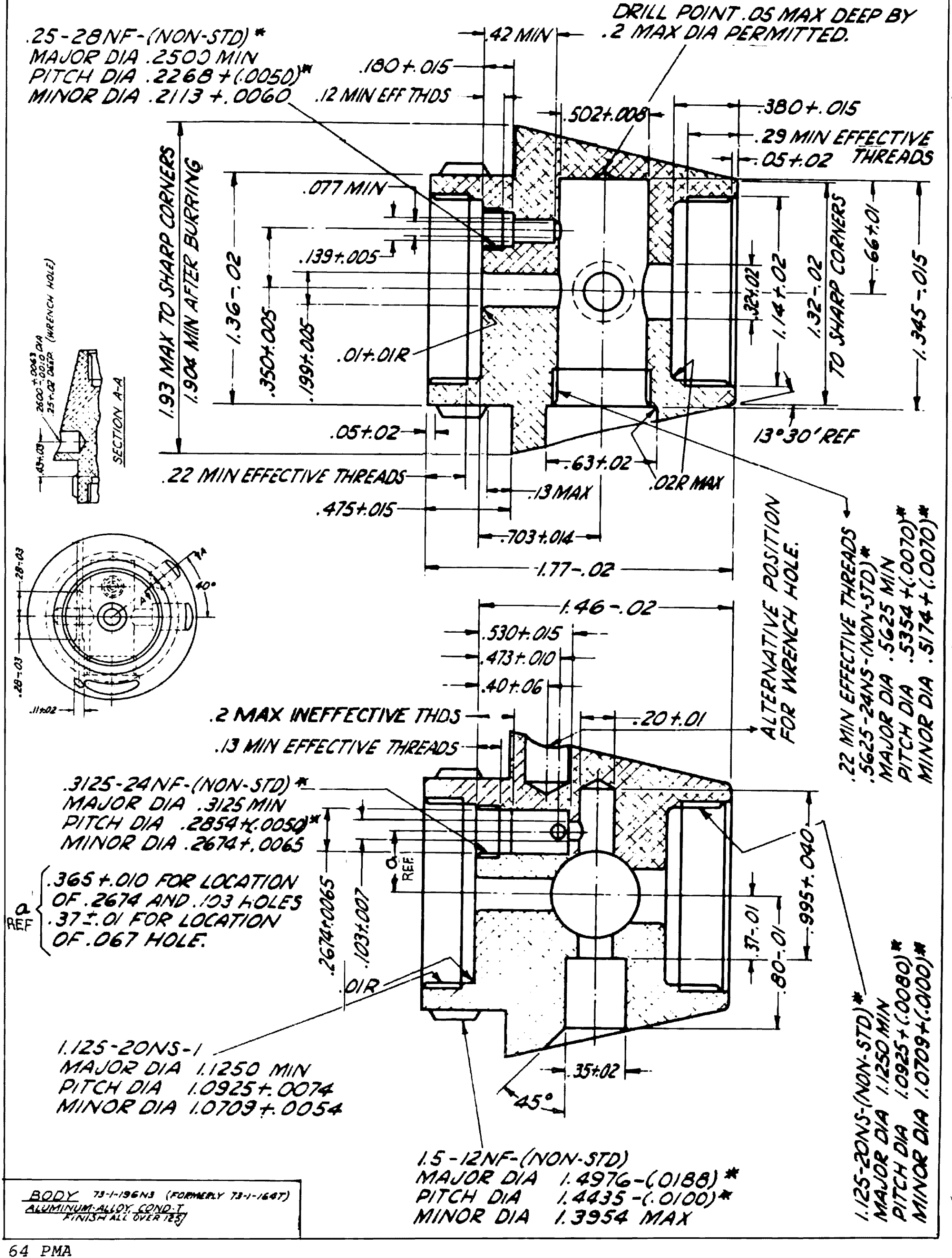
*** SETBACK PIN PLUG** 73-1-163 M BRASS
BRASS ROD

SEE ITEM #4 - PAGE 66

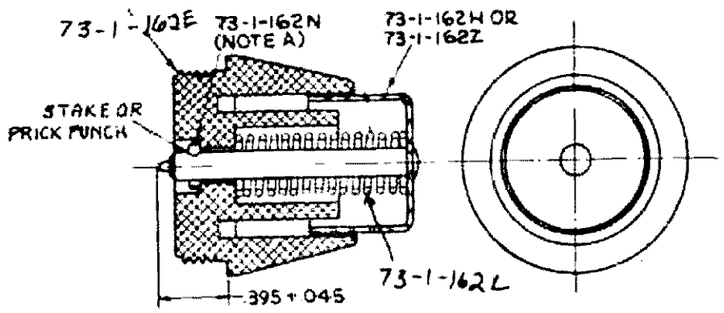


PIN, SLIDER GUIDE 73-1-162T11
STEEL BAR FS 1117 OR B1113, AS-COLD-FINISHED
FINISH ALL OVER 125/

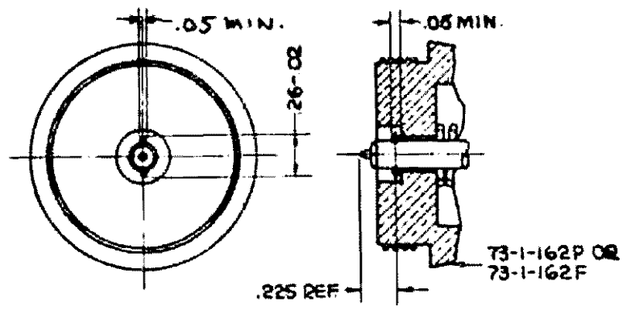
WORKING PARTS FOR M 52 FUZE


.25-28NF-(NON-STD)*
MAJOR DIA .2500 MIN
PITCH DIA .2268+(.0050)*
MINOR DIA .2113+.0060
DRILL POINT .05 MAX DEEP BY .2 MAX DIA PERMITTED.
.42 MIN
.180+.015
.12 MIN EFF THDS
.502+.008
.380+.015
.29 MIN EFFECTIVE THREADS
.05+.02
.077 MIN
.139+.005
1.93 MAX TO SHARP CORNERS
1.904 MIN AFTER BURRING
1.36-.02
.350+.005
.199+.005
.01+.01R
.324.02
1.14+.02
1.32-.02 TO SHARP CORNERS
.66+.01
1.345-.015
.05+.02
13°30' REF
.63+.02
.02R MAX
.22 MIN EFFECTIVE THREADS
.475+.015
.13 MAX
.703+.014
1.77-.02
ALTERNATIVE POSITION FOR WRENCH HOLE.
.22 MIN EFFECTIVE THREADS
.5625-24NS-(NON-STD)*
MAJOR DIA .5625 MIN
PITCH DIA .5354+(.0070)*
MINOR DIA .5174+(.0070)*
SECTION A-A
.2600+.0043 -.0010 DIA
.25+.02 DEEP (WRENCH HOLE)
.43+.03
.28+.03
.28-.03
.11+.02
40°
1.46-.02
.530+.015
.473+.010
.40+.06
.2 MAX INEFFECTIVE THDS
.13 MIN EFFECTIVE THREADS
.20+.01
.3125-24NF-(NON-STD)*
MAJOR DIA .3125 MIN
PITCH DIA .2854+.0050)*
MINOR DIA .2674+.0065
.365+.010 FOR LOCATION OF .2674 AND .103 HOLES
.37±.01 FOR LOCATION OF .067 HOLE.
Q REF
.2674+.0065
.103+.007
.01R
.995+.040
.37-.01
.80-.01
.35+.02
45°
1.125-20NS-1
MAJOR DIA 1.1250 MIN
PITCH DIA 1.0925+.0074
MINOR DIA 1.0709+.0054
1.125-20NS-(NON-STD)*
MAJOR DIA 1.1250 MIN
PITCH DIA 1.0925+(.0080)*
MINOR DIA 1.0709+(.0100)*
1.5-12NF-(NON-STD)
MAJOR DIA 1.4976-(.0188)*
PITCH DIA 1.4435-(.0100)*
MINOR DIA 1.3954 MAX
BODY 73-1-196N3 (FORMERLY 73-1-164T)
ALUMINUM ALLOY COND T
FINISH ALL OVER 125

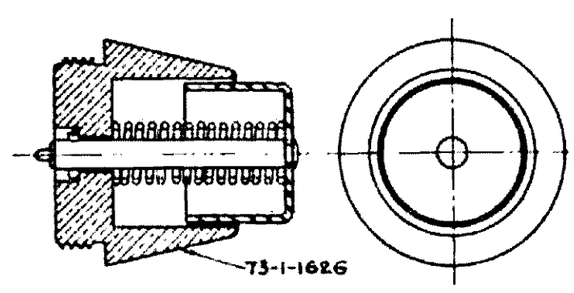
FUZES, POINT DETONATING, M52A1, M52A1B1 AND M82 DETAILS



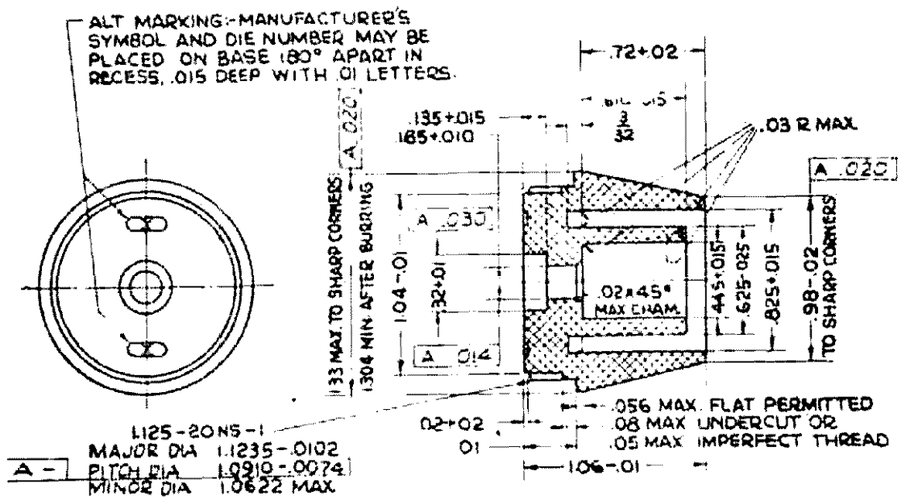
HEAD ASSEMBLY 73-1-162F10

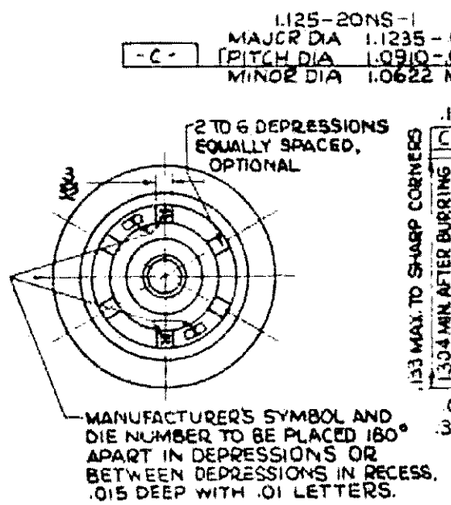


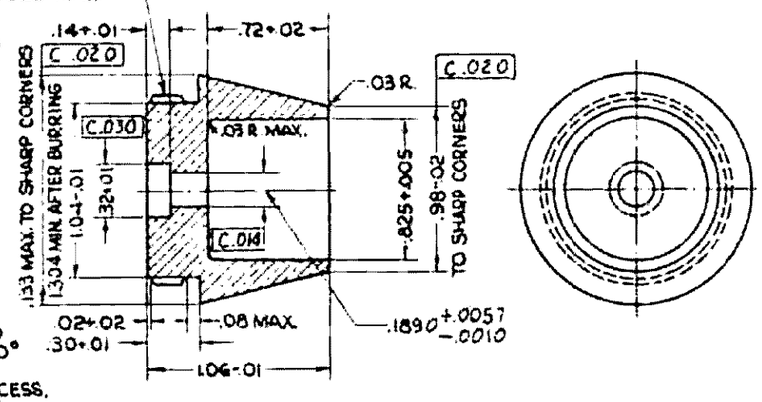
HEAD ASSEMBLY (ALTERNATIVE METHOD)



HEAD ASSEMBLY (ALT.) 73-1-162P10
FOR OTHER INFORMATION, SEE 73-1-162F

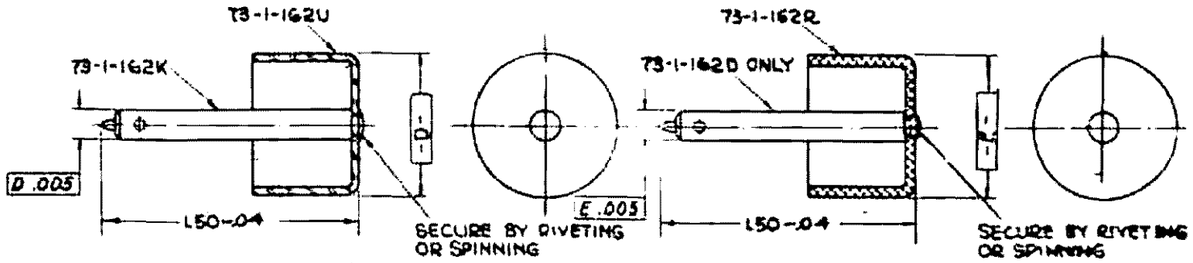






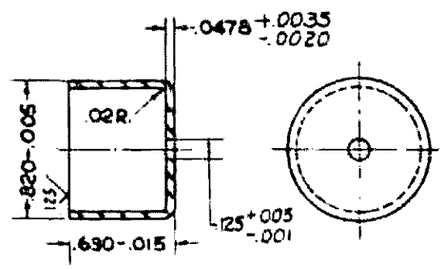
HEAD 73-1-162E11
ZINC-BASE-ALLOY, DIE CASTING, COMP-A OR B, DICHROMATE FILM
MINIMUM WEIGHT, 1125 GRAINS

HEAD (ALT.) 73-1-162G11
COMMERCIAL BRASS, ROD, COMPOSITION "B", HALF-HARD
FINISH ALL OVER 125

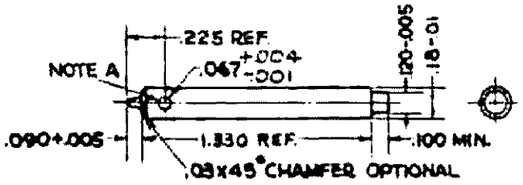


FIRING PIN ASSEMBLY 73-1-162H11

FIRING PIN ASSEMBLY (ALT) 73-1-162J11

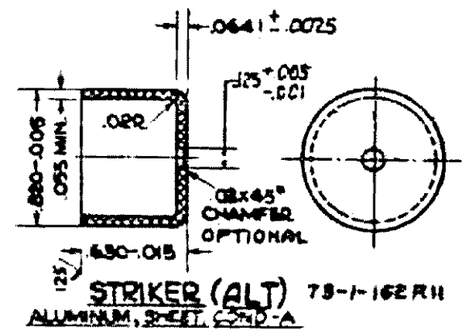


STRIKER 73-1-162U11
STEEL, STRIP, WD1010 OR WD1020, COLD-ROLLED
TEMPER NO. 4, (SOFT SKIN ROLLED) BEST BRIGHT FINISH

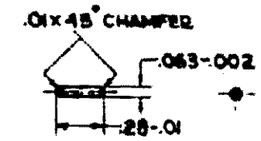


PIN, FIRING 73-1-162K11
STEEL, BAR, FS1010 OR FS1020, AS-COLD-FINISHED
FINISH ALL OVER 125

PIN, FIRING (ALT) 73-1-162D11
ALUMINUM ALLOY, ROD, COND-T
(FOR ALL OTHER INFORMATION SEE 73-1-162K)

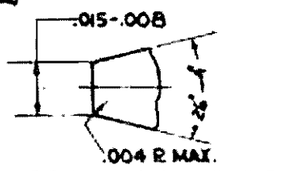


STRIKER (ALT) 73-1-162R11
ALUMINUM, SHEET, COND-A

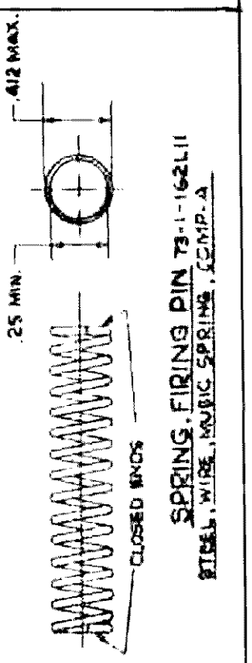


PIN, FIRING PIN LOCK 73-1-162N11
STEEL, BAR, FS1020 OR FS1010, AS-COLD-FINISHED
FINISH ALL OVER 125
(NOTE A)

NOTE A - NOT REQUIRED WHEN ALTERNATIVE METHOD OF HEAD ASSEMBLY IS USED.



DETAIL OF FIRING PIN POINT



SPRING, FIRING PIN 73-1-162L11
STEEL, WIRE, MUSIC SPRING, COMP-A

REQUIREMENTS

A - SOLID HEIGHT NOT OVER .663 INCHES
B - SEASON THOROUGHLY AFTER WINDING
C - WITHIN 24 HOURS AFTER PLATING, TREAT TO REMOVE EMBRITTLEMENT.
D - LOAD AT ONE INCH = 4 LBS., 1 OZ. MIN.
E - LOAD AT .75 INCH = 7 LBS., 1 OZ. MAX., OCCASIONAL CHECK WILL BE MADE AFTER COMPRESSION FOR AT LEAST 24 HOURS AT THIS HEIGHT.
F - LOADS APPLY AFTER SEASONING, PLATING AND TREATMENT TO REMOVE EMBRITTLEMENT.

ADVISORY DATA (NOT MANDATORY)

A - DIAMETER OF WIRE, .039 INCHES
B - TOTAL NUMBER OF COILS = 15 ½
C - NUMBER OF ACTIVE COILS = 13 ½
D - ADJUST FREE HEIGHT TO MEET LOAD REQUIREMENTS
E - SEASON BY HEATING TO 500°F FOR 30 MINUTES.
F - TO REMOVE EMBRITTLEMENT, HEAT TO 300°F FOR AT LEAST 30 MINUTES, AS SOON AFTER PLATING AS PRACTICABLE.